American Dyestuff Reporter

Index to Volume XIV

January 12, 1925, to December 28, 1925, Inclusive

Indexed by Subjects and Authors

TEXTILES PAPER LEATHER

AMERICAN DYESTUFF REPORTER

SAMPLE SWATCH QUARTERLY

JANUARY 12, 1925

XIV

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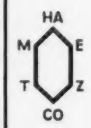

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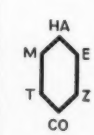

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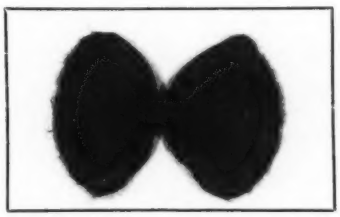

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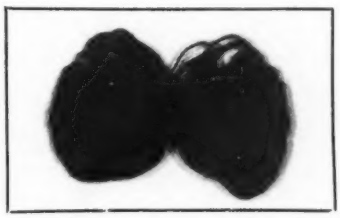

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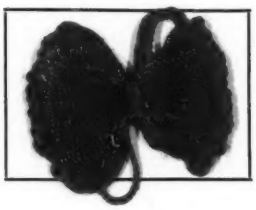

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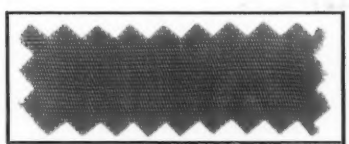

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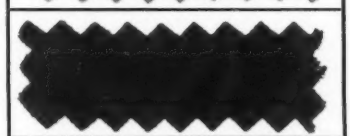

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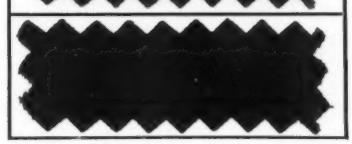

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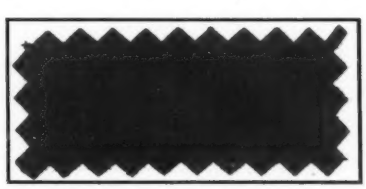

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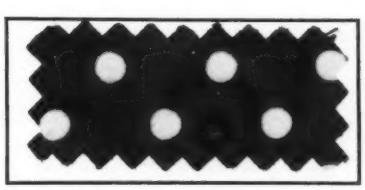

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NEW YORK, JANUARY 12, 1925

Seeing Colors by Geometry

Path of Light—Features of Geometric Arrangement—Method of Examining Sample by Geometric Principles

By WALTER C. DURFEE

EVERY sample of colored cloth displays its color in thousands of different ways, according to light which strikes it and the observer who sees it.

For judging the colors of cloth it is customary to view the samples in certain positions which the observer has found satisfactory.

But if the colors do not continue to satisfy the observer, it is then customary to move the samples a little from place to place and to tilt them and turn them. The observer himself moves into various positions, hoping to get a satisfactory view of the sample.

A quick rule for successfully placing the sample is helpful, especially when the observer is in a strange or unfamiliar place. A rule is also needed for success when one wishes to show color to another person.

In placing samples there are three chief things to consider. These are the light, the sample and the eye. These three may be arranged in so many different ways that a trial of all ways individually is quite impossible. To obtain a successful arrangement it pays to think out the best way and then use it.

Path of Light

So far as results are concerned, if we start with some one position of eye, sample and light we can outline the situation in words most easily by calling attention to the path which the light must have followed from a window to the sample and from the sample to the eye. It is this particular kind of passage to and from the sample which causes the color effect. Between eye and sample there is a straight path for the light. Within and on the sample are various bent and tortuous paths of light on and among the fibers leading to straight paths between the sample and the window.

Thus there is from the window a bundle of straight rays of light converging on the sample and starting from the sample another bundle of rays converging on the eye. These two bundles are arranged about like the two halves of an open safety pin with the twisted part in the cloth, but the eye's bundle of rays contains only a few of the rays which came from the window to the sample.

The cloth receives and scatters and bends the cone of light rays from the window and sends out one little bundle to the eye of the observer. Many other little bundles are sent from the cloth in all other directions, some into the room and some into the depths of the cloth.

These small bundles of light rays are not all alike. They are more or less deeply colored, according to the way the original rays passed into the cloth and out. By moving the eye one can find that the little bundles of light from the cloth differ. By keeping the eye still one can tilt and turn the cloth and see that the sample acts variously on the light and gives a different story to the eye accordingly as the sample is tipped or turned.

Features of Geometric Arrangement

Literally the one sample will yield multitudes of color tones. Some color judges fix upon standard arrangements. Other judges search out the best for each case. Fixed arrangements are needed when it is desired to get fixed results. The varied color tones described here are due to the geometrical arrangements of light rays outlined. The principal feature to consider in such arrangement is the angle between the first general direction of the light which strikes the cloth and the final direction of the light which leaves the cloth and strikes the eye. This angle is a rough measure of what happened to the light within the cloth. Too much or too little action may obscure the color by making it too deep or too pale, and otherwise alter it. The second feature of the geometric arrangement of cloth, observer and light source is the slope of the sample. Everybody knows that the slope of a mirror makes a difference to the image seen in it. It is the same with cloth, which acts like a multitude of microscopic mirrors and colored lenses. The third feature is the direction of the fiber in the cloth. This fiber,

like lenses of certain eye-glasses, can be wrongly placed.

Method of Examining Samfle

In spite of there being perhaps a thousand markedly different combinations of the first two features of light angle and cloth slope, one can examine all of these in two or three seconds' time by the following methods:

Wrap the sample or stretch it onto the surface of a small globe or sphere so as to get every possible surface slope at once. Then hold the covered sphere toward the light and gradually move it in some direction so it will finally be opposite to the light, watching the color of all its parts all the time until it is moved to a position opposite to the light.

In a brief moment the observer will have seen a great variation of color depth and hue, and purity, differing according to light angle and for each part of the globe. Take note of the position of the cloth in the place which showed the best colors. Of course, this experiment should be done with due care to avoid excessively strong or weak light. If steady lighting conditions for this test are desired the window should be very large as compared with the movement employed. With a small window one may hold the ball still and move around it to see the color changes.

When the writer tried this globe test on a number of familiar samples he learned about what angles were good for each depth of color. (The more delicate the color the less did he need to view it in the direction of the window.) He also learned that the best color effect on *that class of goods* was usually obtained when the cloth sloped so as to face as much as possible toward the light, although for convenience it must slope so as to also face the observer to a fair extent.

One can readily find the slope which equally inclines as much as possible to both the light and the observer, because this slope is marked by the shining spot on every polished object. Note the point on the surface of a smooth finger-ring that glistens. Place the cloth in a similar position and slope, and then face it a little more to the light, while turning the fiber perpendicular to both light paths. If you started into a suitable light angle the coloring will probably be very good.*

By a little further study of the geometry of angles one can learn to quickly select a suitable background without sacrificing the successful arrangement of angle and slope. For example: If the sample were a medium shade and one consequently desired to view the sample looking at right angles to the light, one could find a number of ways of looking, either down, up or horizontal, etc., and in each case the correct cloth slope could be also found. Colors require a suitable background.

Geometry further tells us that a window near by will throw on the sample a cone of light very different from a window less near. Narrow cones of light are useful for various purposes, which may be discovered by trying them on various samples and otherwise. These narrow lights are found near the sides of the window and also at a sufficient distance in front of it and in the circle containing these points. (Sometimes, however, big windows should be partly covered.)†

On clear days the choice of position for samples, except those viewed in a direction much away from the light, may involve an attempt to be looking across the direction of the sun's rays. The need for this, and also to receive light from another crosswise direction, cannot be explained here, but the results often speak for themselves.

After a little study of the various matters above mentioned and a little examination of familiar colors on the sphere or globe so as to fully realize what this article is about, it should be possible to go into any strange room and with very little hesitation select a position at about the right distance from the window in about the right direction from it, and then, after glancing at some polished object held at about the correct light angle (against the best available choice of background), decide how to place the sample for observation and get it turned properly while placing it there.

In short, out of a host of possible positions for viewing color, one can find after a little experimentation a truly superior one.

*If the fiber has two general directions, use one of the averages of these directions; or else the direction of those fibers whose color you most wish to see. If you cannot quickly decide about the fiber, look through the cloth at a bright light and note the weave or the cross of colored light having arms perpendicular to the fibers producing them.

†Moderations of light by choice of window aspect will make bright colors either better or worse, just as the partial closing of the eyes will. Also, just as useless light striking against eyelashes may interfere with color vision, so will useless light shining on the cloth produce useless lusters and poor backgrounds. Often a narrow cone of light is all that is needed to develop a rich coloring from a sample which is viewed in the so-called overhand position looking along its surface nearly toward the light.

NEW DYE WORKS IN JERSEY

The Somerset Aniline Works, Inc., located near Pluckemin, has filed a certificate of incorporation in the County Clerk's office which authorizes the new company to do business with a capital stock of $100,000. The incorporators are Alfred Klein and Julius Winkler, of Pluckemin, and Alfred Winkler, of Far Hilis. The process agent is Alfred Winkler. The Somerset Aniline Works, Inc., is empowered to manufacture, buy and sell dyestuffs and to perfect whatever secret processes are necessary to carry on the business of the company.

Gas Singeing of Cotton Pile Fabrics

Importance of Singeing Pile Fabrics—Elimination of Loose Fibers—Types of Singers—Chemical Action of Copper Plates

By JOHN T. TRAVIS

SO far as the short pile fabrics such as cotton velvets, velveteens and corduroys are concerned, all manufacturers freely admit that it would be impossible to produce a satisfactory finish on these fabrics if the singeing process was omitted, as the presence of fuzz and lint in abundant profusion, would prevent the lustering of the pile yarn.

This is on account of the dulling effect of this fuzz, which crisscrosses in such a manner that unless it is eliminated entirely, the proper alignment of the true fibers cannot be had, nor the true luster of the yarn shown, by the refraction of light from fiber to fiber.

As everyone knows, a pile fabric consists of a cloth having a firm interlacing weave as the background of the fabric, the pile being composed of innumerable cut ends of yarn, interlocked with the background weave.

It very naturally follows that in the cutting of the pile yarn, many of the cotton fibers, originally of a given length of, say, one and a quarter inches, are cut into various lengths in the cutting operation. It does not materially matter whether this cutting is done by hand or machine after the goods leave the loom, as in the case of velveteens and corduroys, or whether this takes place after the goods are woven but are yet on the loom, as in the weaving and cutting of most of the cotton plushes; the principle involved is the same, and a similar resultant effect must very naturally follow.

Elimination of Loose Fibers

When we remember that cotton yarn, as used in the weaving of fabrics, is really composed of a countless number of short fibers twisted together, it will readily be understood that at the point where the actual cutting takes place, many of the fibers, originally of practically the same length while twisted together in the yarn state, are cut up into innumerable short lengths, many of which are not long enough to reach the binding of the interlacing weave, and are therefore but very loosely attached to the fabric.

The true pile consists only of those fibers which are firmly bound by the interlacing of the weave, and the loose irregular fibers must be eliminated, or a dull matted effect will result in the finishing.

Many of these loose fibers brush out in the after processing of the fabric, but too much brushing has a tendency to impoverish the pile, and it is not possible to eliminate all of the loose fibers by the brushing process.

As many of these short unbound fibers therefore remain embedded in the pile, and on account of the very nature of the cotton fiber are not readily dislodged by the brushing process, it is quite evident that they must be cleaned out by some other method which will not be harmful to the fabric, nor unduly impoverish the pile.

The heavier the pile, the more difficult will be the cleaning out of these short fibers, especially from the bottom of the pile, near where the pile yarn is bound in the back of the fabric.

The full importance of the singeing operation has long been recognized by the finishers of such short-pile fabrics as cotton-velvets, velveteens and corduroys, but it is a surprising fact that the manufacturers of the heavier pile fabrics such as cotton plushes, have not yet sensed the true necessity for a thorough cleaning out of the fuzz and lint present in these fabrics, when the goods leave the loom.

The singeing of such heavy fabrics as cotton plushes would of necessity require the most powerful and efficient singeing equipment obtainable, on account of the depth and density of the pile, as a superficial singeing by any of the ordinary gas singers of the open burner types would be quite inadequate to thoroughly cleanse the fabric from the tremendous amount of the loose fibers and lint, caused by the cutting-up of the pile yarn, nor thoroughly rid the yarn of the "roughed up" fibers, caused by abrasion in the weaving process.

It is not the purpose of this article to deal with the various methods of preparation of the cloth for singeing, but rather to emphasize the necessity of the singeing operation.

Types of Singers

As above referred to, none but the most efficient type of singer can thoroughly cleanse the heavy cotton plushes, as the great heat intensity required to readily burn up the loose fibers and lint could not be maintained on any of the ordinary singeing equipment as is at present in general use by finishers of ordinary plain cotton fabrics.

The type of singer which until recently was found most suitable for use where high heat intensity was necessary, is the hammered copper stationary plate singer, but where extreme heat intensity is of the utmost importance, and is absolutely necessary as in the case of cotton pile fabrics, the copper metal has been found to have many unsatisfactory features, especially in regard to the lack of sufficient tensile strength, and also as to the very great oxidation of the metal at even moderate temperatures.

Copper loses about 43 per cent of its tensile strength at a dull red heat, and at 360 deg. Fahr. oxidation sets in.

The copper oxide which freely scales off the copper plate at even moderate degrees of heat naturally is to some extent carried off by the passing of the fabric over the heated copper plate, and particularly in case of a cotton pile fabric is held in the fabric through the subsequent processes of boiling, bleaching and dyeing.

Chemical Action of Copper Plates

To one of the leading and best informed chemists in the textile industry, the writer is indebted for the following information with regard to the chemical action which takes place in the processing of cotton fabrics, when the singeing has been done on superheated copper plates:

> Through the action of the chemicals used in the boiling and bleaching processes, the copper oxide is converted into other copper compounds, and these compounds or copper sales have a "saddening" or dulling effect on many of the direct cotton colors used in dyeing, and also results in the "shading" of the fabric in the dyeing process.
>
> When it is remembered that copper vessels cannot be used for dyeing cotton fabrics with many of the direct cotton colors, it will be readily understood that the presence of any of the copper oxide of scale in the fabric is very objectionable.

No doubt the need of efficient singeing equipment has had a great deal to do with the lack of interest on the part of the manufacturers of heavy cotton-pile fabrics, but when the producers of this merchandise really sense the possibilities of improvement in the finishing of their product there is little doubt but that the singeing of all classes of cotton pile fabrics will be generally adopted.

As everyone connected with the finishing of cotton fabrics knows, too much importance cannot be given the absolute necessity of efficient singeing, if satisfactory results in the finishing of the merchandise are to be obtained.

The elimination of the fuzz and lint present after the cutting of cotton plushes on the loom can effectually be attained, but only by the application of heat intensity capable of reaching and burning up these short fibers, without materially affecting the true pile which is bound thoroughly in the fabric.

After this burning up of the fuzz and line is accomplished it then becomes a relatively easy matter to eliminate all the burnt ash from the fabric, as this can very readily be brushed out.

The research work and intensive study of the problems of singeing, carried on over a considerable period by the American Gas Furnace Company, has resulted in their having perfected the "American" as the latest type of rotary plate gas singer. This is designed to meet, by the use of the non-oxidizing Nichrome cylinder, the most exacting singeing requirements of the cotton pile fabric trade, as to economy of operation and maintenance, and efficiency of production.

The article in a previous issue of The Reporter covered the construction and method of operation of this latest singeing apparatus, and it is needless therefore to comment on these details further.

It might be worth while to add, however, that the tensile strength of Nichrome at singeing heat (1,400 deg. Fahr.) is equal to that of copper at atmospheric temperature (that is to say, cold).

Also, while oxidation of copper begins at about 360 deg. Fahr., Nichrome shows practically no oxidation below 2,000 deg. Fahr.

DYE SALES TO DECEMBER 30 RECORD 33 PER CENT DROP

In order that data may be available to study the effect of the reduction in duty on dyes, September 22, 1924, the Tariff Commission has recently completed a compilation of the total sales of domestic dyes for the first nine months of 1924 and 1923. These data, together with the sales for the whole year of 1924, which the Commission is now gathering, and with the imports of dyes by months will enable the Commission to analyze further the effects of the reduction in the duty on dyes.

The total sales of coal tar dyes of domestic manufacture for the first nine months of 1923 were about 64,500,000 pounds, valued at $36,500,000, while the total sales for the first nine months of 1924 were about 47,200,000 pounds valued at $24,300,000. Sales by quantity for the first nine months of 1924 represent a 27 per cent decline from those of 1923, while by value the reduction was 33 per cent. The average selling price for the first nine months of 1924 was 51 cents per pound, or about a 9 per cent decline from the price during the corresponding period of 1923, which was 56 cents. These values may be compared with an average sales value of 54.5 cents for twelve months of 1923, 60 cents for 1922, 83 cents for 1921 and $1.26 for 1917.

The principal reason given by the dye manufacturers for changes in the volume of sales during 1924 as compared with those of 1923 was the reduction in the activity of the textile and other dye-consuming industries.

Other reasons given for the reduction in dye sales during 1924 were:

(a) Delayed purchased of dyes in anticipation of the reduction in import duties on September 22, 1924.

(b) Keen competition among domestic producers. A number of the firms reported sales during 1924 at and below cost of production.

(c) Increased imports of certain dyes, which reduced the sales of those firms producing only these colors.

(d) Popularity of light shades during 1924, which reduced the consumption of dyes.

A reduction in total sales was not reported by all domestic companies. In the case of a few firms the value of sales increased due to the manufacture of new dyes of a higher value instead of the production of cheaper dyes.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

FAST MORDANT YELLOW
(Schultz No. 294)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool (loose wool), yarn and pieces.

USUAL METHOD OF DYEING: Top and bottom chrome.

SHADE: Redder than S-177.

SHADE BY GASLIGHT: No change in shade.

SOLUBILITY: Good.

LEVEL: Top-chromed, requires care with pieces.

EXHAUSTS: Well.

FASTNESS TO:
- **Acid:** Redder with 1-10 sulphuric acid. Brownish red with strong muriatic.
- **Alkali:** Fast.
- **Carbonizing:** Better than S-177 or S-103.
- **Fulling:** Better than S-48, S-102 or S-177. Does not stain white cotton or white wool.
- **Ironing:** Fast.
- **Light:** Better than S-48, S-103 or S-177.
- **Perspiration:** Fast; stands Government lactic and citric acid tests better than S-48 and S-177.
- **Potting:** Fast.
- **Rubbing:** Crocks slightly.
- **Scouring:** Stands boiling soap and soda better than the other yellows.
- **Steaming:** Excellent.
- **Sulphur:** Shade goes much greener.
- **Washing:** Better than S-48 and S-177.

OTHER PROPERTIES: White cotton and silk effect threads are stained.

DYED BY OTHER METHODS: Dyed chromate, the color exhausts well in a weakly acid bath either with or without chrome, and gives a full bright yellow very fast to fulling, washing, sulphur, carbonizing, steaming, potting and light.

ON UNIONS: Cotton-wool unions: Dyed neutral the wool is a full yellow shade fast to light, washing, fulling, steaming and stoving.

ON OTHER MATERIALS: Silk: Dyed on a chloride mordant, very fast to soap and water. Can also be dyed in an acetic acid bath (no chrome). Fast to light and washing. It also dyes silk well chromate.

PRINTING: Suitable for printing on slubbing with chrome. Can also be printed on oiled cotton with acetate of chrome.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Company (Selling Agents, John Campbell & Co.).

BENZO FAST YELLOW
(Schultz No. 296)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton and wool.

USUAL METHOD OF DYEING: Cotton: With salt; more level with addition of soap or phosphate of soda. Not suitable for padding. Do not use soda. Wool: With Glauber salt and acetic acid.

SOLUBILITY: Good; 10 grains per liter.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO (ON COTTON):
- **Acid:** Turns gray.
- **Alkali:** Turns red.
- **Chlorine:** Fugitive.
- **Cross-Dyeing:** Not fast.
- **Fulling:** Moderate against cotton.
- **Light:** Very good.
- **Rubbing:** Fast.
- **Sulphur:** Fairly good; reddish spots.
- **Washing:** Stains into white.

FASTNESS TO (ON WOOL):
- **Acid:** Fairly fast.
- **Cross-Dyeing:** Not fast.
- **Fulling:** Fair; stains white silk-effect threads slightly, cotton threads badly.
- **Light:** Good.
- **Perspiration:** Fast.
- **Rubbing:** Crocks slightly.
- **Washing:** Fairly fast.

SENSITIVE TO METALS, LIME: Not sensitive to copper and iron.

OTHER PROPERTIES: Fast to soda lye and adapted for crêpe effects.

DYED BY OTHER METHODS: After-chromed on cotton, the shade is duller. After-coppered on cotton, the shade turns to a yellowish olive and is very much faster to washing. Dyed cold on cotton at 100 deg. Fahr., wool is left white and also silk. Developed with nitrosamine on cotton and coppered, gives a full yellow (very fast to washing).

ON UNIONS: Cotton-wool unions: Wool dyed darker than the cotton. After coppered and chromed, the color is good for shoddy unions and stands some fulling.

ON OTHER MATERIALS: Silk: Dyed in a slightly acid bath, very fast to water and light. Cotton-Silk: Both fibers

about equal use 30 per cent Glauber, 10 per cent soap, 2 per cent sal soda. Wool: Dyed with Glauber salt and acetic. Top-chromed, faster to washing and fulling. Can also be dyed chromate and is fast to light. Paper: Good on unsized pulp. Cotton: Good with acetate of chrome. Wool: Good without a mordant.

DISCHARGING: Cotton: Discharges white with sulphoxalates. Wool: Does not discharge well.

REMARKS: The color will dye on cotton-wool-silk unions covering all fibers. It is best dyed by one of the following recipes: (1) With 10 per cent salt, one hour at 100 deg. Fahr. (2) With 10 per cent soap, 10 per cent Glauber salt, one hour at 100 deg. Fahr. (3) With 10 per cent soap, 5 per cent soda ash, one hour at 80 deg. Fahr. (4)) With 10 per cent soap, 10 per cent phosphate of soda, one hour at 80 deg. Fahr.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.; Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.).

BENZO FAST PINK 2BL

(Schultz No. 297)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Glauber salt and soda or soap.

SHADE: Bluer than Thiazine Red (1-194); yellower than Erica (S-121).

SHADE BY GASLIGHT: No change in shade.

SOLUBILITY: Good.

LEVEL: Dyes level in light percentage.

EXHAUSTS: Better than Erica or Geranine.

FASTNESS TO:

Acid: Fast to acetic or formic acid.
Alkali: Fast.
Chlorine: Will not stand bleaching.
Cross-Dyeing: Will not stand cross-dyeing.
Ironing: Temporarily yellower. The shade returns on cooling.
Light: Excellent. Better than the Ericas or Geranine.
Rubbing: Fast.
Sulphur: Fast.
Washing: Faster than the Ericas.
Water: Fairly fast.
Peroxide: Fast.

SENSITIVE TO METALS, LIME: Not sensitive to copper.

MACHINE DYEING: Suitable.

DYED BY OTHER METHODS: Good when dyed cold. Dyes well on mercerized material and is suitable for pad dyeing.

ON UNIONS: Cotton-silk unions: Suitable; leaves the silk white.

ON OTHER MATERIALS: Wool: Produces a dull red relatively fast to fulling. Weighted Silk: No interest.

PRINTING: Well adapted for cotton printing. It is applied with phosphate of soda. The shade on cotton can be discharged white with zinc dust. With tin it gives a moderately good discharge. Better for a color discharge with oxidizing agents. It is also suitable for slubbing and wool piece printing, and also for printing on silk, half-silk, linen, half-linen, gloria and jute.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co. and Amalgamated Dyestuff & Chemical Works.

PAPER YELLOW

(Schultz No. 303)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton and paper.

USUAL METHOD OF DYEING: Dyes cotton direct from a common salt bath acidulated with acetic acid.

SHADE: Bright pure yellow.

SHADE BY GASLIGHT: Brighter.

SOLUBILITY: Good.

FASTNESS TO (on Cotton):

Acid: Fast against dilute organic acids.
Alkali: Shade turns much redder.
Light: Very fast to light.
Washing: Bleeds off with soap.

ON OTHER MATERIALS: Paper: Suitable for unsized pulp. Is dyed with an excess of alum. Very fast to light.

DISCHARGING: Does not discharge white.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; E. I. du Pont de Nemours & Co.; National Aniline & Chemical Company; Newport Chemical Works, Inc.; Essex Aniline Works (Selling Agents, Grasselli Dyestuff Corporation).

DU PONT ADDS FOUR NEW VATS TO LIST

The Dyestuffs Department of E. I. du Pont de Nemours & Co. have just placed on the market four vat colors, which have not previously been produced in America. Three of these are Ponsol colors which are described as possessing exceptional fastness properties. They are known as Ponsol Brown G Double Paste, Ponsol Brown R Double Paste and Ponsol Black BB Double Paste, and have been prepared to meet the needs of the cotton printing trades for use in shirtings, draperies, upholstery, dress goods, or any fabric where maximum fastness is required.

The fourth color, known as Sulfanthrene Scarlet 2B Paste, is a vat color of the Sulfanthrene Series, and like all the other members of that group possesses excellent fastness to water, perspiration, chlorine, cross-dyeing and the like. The light fastness is also very good, but the Sulfanthrene colors are exceeded in this respect by the Ponsol group. It dyes a bright bluish shade of scarlet on cotton. This color may be used also on artificial silk.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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FOURTH ANNUAL MEETING

[EDITOR'S NOTE.—*Following is a full report of the session held in the Bellevue-Stratford Hotel, Saturday morning, December 6, 1924. It includes the papers presented at this session and the discussions which followed these papers. A report of the Saturday afternoon session containing the symposium on artificial silk will appear in the issue of January 26. The Proceedings of the Banquet Session which concluded the Fourth Annual Meeting were published in the issue of December 29.*]

SATURDAY MORNING SESSION

December 6, 1924

The Fourth Annual Meeting of the American Association of Textile Chemists and Colorists convened in the Bellevue-Stratford Hotel, Philadelphia, at 10.00 A. M., Professor Louis Olney, president, presiding.

President Olney—In calling together the Fourth Annual Meeting of the American Association of Textile Chemists and Colorists, I wish to express the appreciation of the Association for the time and thought the Philadelphia Committee has given to the arrangements for this meeting.

Philadelphia is certainly a very fitting place for a meeting of a textile chemists and colorists association. In addition to that, we have had the benefit of the fact that we have an active local section in Philadelphia, and I am sure our wants and requirements have been excellently provided for.

We called this meeting at rather an early hour because we have a great deal of business to transact in one day and we thought if we did not get an early start we should not be able to complete our program in time. We have placed the business meeting first because we know that many would prefer to lose certain portions of that rather than the papers which are to follow. I will first call for the Secretary's report. Mr. Hadley.

. . . Mr. Hadley presented his prepared report as follows:

SECRETARY'S REPORT

For the Year Ended December 6, 1924

During the year ended December 6, 1924, the Association has admitted to membership:

146 Active members
56 Junior members

Three Active members have withdrawn during the past year and four Junior members have been transferred to Active membership.

The membership at the present time is as follows:

5 Corporate members
599 Active members
167 Junior members

771 Total

The Council has held eight meetings, seven in Boston and one in Philadelphia.

The Research Committee has held seven meetings.

The Association has published a 1924 edition of the Year Book.

A Southern Local Section has been formed.

Respectfully submitted,

W. E. HADLEY, Secretary.

President Olney—Are there any questions or corrections in regard to this report? If not, a motion to accept it is in order.

Wm. H. Cady—I move its acceptance.

. . . The motion was seconded by W. K. Robbins and carried. . . .

President Olney—Before we proceed to the Treasurer's report I think we had better get started with our election, because that takes considerable time. According to our Constitution the President shall cause the ballots to be opened and counted and the vote announced and the officers elected shall take office immediately.

In order to comply with that provision I am going to appoint Mr. Percival Theel and Mr. Stanley Garnett as tellers, if they are here and are willing to serve. Are either or both of those gentlemen present? (Mr. Garnett was present.) I asked Mr. Theel if he would serve and he said he would if he could get away before eleven o'clock.

Dr. Charles S. Hollander—He has classes this morning; I think he went back to the Textile School.

President Olney—Mr. Lewis, would you serve as a teller?

L. C. Lewis—Yes, I will be glad to.

President Olney—Then Mr. Lewis and Mr. Garnett will serve as tellers.

We will next have the Treasurer's report. Mr. Durfee.

. . . W. C. Durfee presented his prepared report as follows:

TREASURER'S REPORT

For the Year Ended December 6, 1924

Dues received	$2,720.00
Corporate Memberships	225.00
From the Year Book	26.50
Refund for Advertising	216.20
Journals to Outsiders	9.14
Emblems	229.60
Bank Interest	44.72
Total	$3,471.16
Expenses	
For the Administration	$1,119.45
For Sections	493.000
For Journals	1,714.38
Totals	$3,326.84

That leaves a balance for the year of $144.32. The balance would have been much larger had more members paid dues for the year 1924. Undoubtedly, these will come in.

There was a balance of cash on hand November, 1923, of $1,124, which makes a total balance on hand to-day of $1,268.32, as of November 11th.

President Olney—You have heard the Treasurer's report; are there any comments or questions? If not, a motion to accept is in order.

W. K. Robbins—I move the report be accepted.

. . . The motion was seconded and carried. . . .

President Olney—I believe that concludes the reports of officers. In the past it has been customary for the President to combine his report, if it might be called that, with the talk he gives in the evening, and it is my intention to do that again this year, so I will not anticipate what I shall have to say then by making any special remarks at this time.

I wish to call the attention of the members to the exposition of the Chemical Equipment Association which is to be held in Providence next June. The Council has already recommended to the Rhode Island Section and the Northern New England Section that they have a combined meeting in Providence at that time, to which all members of the Association should be invited, and I hope that we can have in conjunction with that meeting a more or less general meeting of the Association without officially designating it as such. Our Constitution calls for only one general meeting a year. I have a letter here written by Mr. Roberts Everett, Secretary of that Association; it reads as follows:

"Louis A. Olney, President, American Association of Textile Chemists and Colorists.

"Dear Professor Olney:—We are hereby tendering an invitation to each and every member of the American Association of Textile Chemists and Colorists to attend the first Chemical Equipment Exposition to be held in Providence, June 22nd and 27th inclusive, 1925. We sincerely wish to impress upon you that this is your exposition, or should be. It is an exhibit of manufacturers of machinery, equipment and raw materials to be used by the chemically controlled industries of the United States. Nearly one hundred leading manufacturers at this early date have signified their intention of exhibiting. This means an exhibit of the latest and newest apparatus and methods displayed in a comprehensive manner by men capable of explaining their products and the uses thereof.

"It is a non-profit making exposition. It is being conducted by the Chemical Equipment Association in the belief that they themselves can assemble a broader array of equipment than has ever been shown before. It is an assembling of the best engineering and manufacturing brains, to show you, the users of equipment and raw materials, the products in which you are interested, under one roof in one place without the interruption of the ordinary sightseers, the laymen, as there is no public admission and only engineers, chemists and executives are invited.

"It is our belief that a full attendance of your Association will greatly enhance our mutual understanding and betterment, and we take this occasion to invite

your organization officially to meet in conjunction with the exposition.

"Yours very truly,

"ROBERTS EVERETT,

"Secretary, Chem. Equipment Ass'n."

President Olney (continuing)—I might add that the American Institute of Chemical Engineers will have their regular meeting in Providence at that same time, and it appears now as though there will be quite a gathering of men who are interested along chemical lines. I might also say that Mr. Boyd, who is one of the officials of this association, is here in Philadelphia and if I am not mistaken he is here this morning. He may not be in the room, but I know he is somewhere about the hotel and if any of you are especially interested in this matter I know he would be pleased to talk to you in regard to the Providence exposition.

We have several sub-committees of our Research Committee which are to make reports at this time. I will call on Mr. William H. Cady, Chairman of the Committee on Fastness to Light.

. . . Mr. Cady presented the prepared report of this Committee, which will be published in full in an early issue with the discussion that followed its presentation.

President Olney—We also have a recently appointed "Committee on Fastness of Alkalis and Acids, including Carbonization"—that is the way it appears on the program, but I believe the Committee is of the opinion that the Alkalis and Acids should be separated from the Carbonization. We will hear from that Committee now if Mr. Moorhouse is here. Mr. Moorhouse and Mr. Leitch are on the Committee; are either of those gentlemen present?

. . . Mr. Moorhouse was not present at this time, but his prepared report was submitted later and is published herewith. . . .

STANDARD TESTS FOR FASTNESS TO ACIDS AND ALKALIES AND SELECTION OF STANDARDS

Submitted by WILLIAM R. MOORHOUSE, *Sub-Committee Chairman.*

FASTNESS TO ACIDS

Dyed textile materials would come in contact with acids when subject to the following: Carbonizing, Cross-Dyeing, Acid Milling, Perspiration, Urine, Acid Fumes in Print Works, Acid Sizes, Ammonia Fumes.

Carbonizing, cross-dyeing, acid milling, and fastness to perspiration should be treated separately, and the last is already being taken care of by other committees.

The tests we are contemplating using, and the standards selected, are designed to cover the change of shade when the dyed material comes in contact with acid fumes, acid sizes, etc.

TESTS FOR DYED COTTON

No. 1.—The dyed material is spotted with hydrochloric acid, at 70 deg. Fahr., made up with 100 c.c. 35 per cent hydrochloric acid per liter.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slightly altered; Class III distinct alteration.

No. 2.—The dyed material is spotted with 56 per cent acetic acid.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slightly altered; Class III distinct alteration.

In regard to colored wool, outside of fastness to acid milling and carbonizing, there does not seem to be other tests necessary, as practically all dyed wool is fast to acid fumes and to dilute acids such as change colored cotton dyed with certain dyes, with the exception of one or two of the natural dyestuffs. These remarks apply also more or less to silk.

FASTNESS TO ALKALIS

Dyed textile materials would come in contact with alkalies when subjected to the following: Fulling, Scouring, Washing, Mercerizing, Neutralizing After Carbonizing, Perspiration, Alkaline Sizes and Dressings, Alkaline Cleansing, Alkaline Street Dust.

Fulling, scouring, washing, mercerizing and neutralizing after carbonizing, should be treated separately. Fulling, scouring and washing have already been taken care of by other committees.

The tests we are recommending, and the standards selected, are designed to cover the change of shade when the dyed material comes in contact with alkaline street dirt, alkaline sizes and dressings, alkaline cleansing, etc.

TESTS FOR DYED COTTON

No. 1.—The dyed material is steeped for two minutes at 70 deg. Fahr. in concentrated ammonia containing 28 per cent NH_3 and dried without rinsing.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slight altered; Class III distinct alteration.

No. 2.—The dyed material is steeped for two minutes at 70 deg. Fahr. in a 10 per cent sodium carbonate solution and dried without rinsing.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slight altered; Class III distinct alteration.

Tests for Dyed Wool

No. 1.—The dyed material is steeped for two minutes at 70 deg. Fahr. in a 10 per cent sodium carbonate solution squeezed out and dried without rinsing.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slight altered; Class III distinct alteration.

No. 2.—The dyed material is spotted with a freshly prepared calcium hydroxide paste, allowed to dry and then brushed off.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slightly altered; Class III distinct alteration.

No. 3.—The dyed material is hung in a four-liter bell jar that is placed over a glass plate, on which there is placed a 3-inch diameter evaporating dish containing 10 c.c. concentrated ammonia (28 per cent NH_3). A twenty-four hour exposure is made.

Change in shade is noted.

Those that would fall in Class I are not altered; Class II slightly altered; Class III distinct alteration.

The same tests are used for dyed silk as for dyed wool.

President Olney—Is there any further business to come before the Association as actual business? We shall have to wait a while longer, I think, for our tellers to report. In the meanwhile, we are perfectly glad to have them do their work here in this room because it would be unreasonable for us to ask them to go out for an hour or two and miss the meeting while performing their duty as tellers. They can perform their official duties and listen to the papers at the same time, I believe.

Our first paper this morning is entitled "Experiences with Micro-organisms and Insects in Textile Work," by Mr. Arthur K. Johnson. Mr. Johnson. (Applause.)

EXPERIENCES WITH MICRO-ORGANISMS AND INSECTS IN TEXTILE WORK

By Arthur K. Johnson
Lowell Textile School

Producers and consumers of textile materials are fully aware of the constant danger to these materials from ravages by insects and micro-organisms, particularly bacteria and certain types of mildew or molds. They are also aware of the need for eternal vigilance in preventing this injury. It seems, however, that, owing to the large economic loss which comes every year either in the production or in the use of textile material, our present day defenses are not altogether adequate. This may be either through careless disregard of the application of known conditions for their control, or owing to inability under the particular conditions of the exposure to apply these methods.

The question of insects, I think, is one which hits the manufacturing end of the industry a little more frequently perhaps or to a larger extent than the question of bacteria and mildew. If I might briefly mention some of the different types of insects which have either a humorous or actually damaging influence in the textile work, there might be included the boll-weevil, wood-borers, cockroaches, cereal and clothes moths and carpet-beetles. The boll-weevil is a serious menace at the present time in the production of cotton.

There was recently a rather curious type of damage to textile material related to me, a case of damage by wood-borers. It seems that a certain shipment of cotton cloth was packed in wooden boxes, the wood of which was infected with wood-boring organisms. This organism took it into its mind, if it has a mind, to leave the wood of the packing cases, and, boring through the cloth, it nestled into the wood of the wrapping boards. This represents a rather unusual and, I think, a rather curious and interesting type of damage from wood-borers.

Then we have that other type of insect which we all like to see the departure of—cockroaches. On the question of cockroaches, we have a rather serious problem for consideration. I can well remember one instance of a mill which had an abundance of these creatures. It used to be a part of the Sunday morning indoor sports to spray around in the different places with powder-guns and insecticide, and then to make room for the next invasion of insects on Saturday night by the generous use of paddles and other things. This represents, perhaps, a minor attempt to clear the laboratory, at any rate, of these pests. Whenever we approached a locker with the spray from these guns, the armies of insects which beat a retreat were quite appalling.

The conditions under which cockroaches seem to thrive best are proper conditions of moisture, temperature and food. They are creatures of the dark in their normal activities. The thing that is important with us is the question of their food. They are great likers and partakers of practically all types of food which are suitable for human beings, and, in addition, they are said to live very well on dead animal matter and the cereals which are commonly used in textile plants. Occasionally, reference is made to the damage incurred by these insects gnawing woolen materials, and, in libraries and other places, eating leather and book-bindings. The actual damage, of course, is done first of all by eating and secondly by soiling or spoiling the rest of the material.

We might speak rather briefly of their life cycle. The organisms are hatched from eggs as the miniature insect. The insect is rather slow in the matter of growth, from

six to twelve months being necessary to produce the adult. These insects are by nature of rather long life [having also great capacity to dodge the hand and foil the wiles of man].

One or two points in favor of cockroaches, if we can consider them as such, is that they do act as scavengers. They certainly eat up quite a bit of material. Another point, of rather humorous connection, is their natural enmity toward another insect closely associated with certain kinds of textiles, namely, the bedbug. It is said that cockroaches and bedbugs don't get along at all well and usually the other bug is at a disadvantage when cockroaches are in the field.

There are various methods suggested for holding cockroaches in check. Certain types of parasites are a means of damaging or injuring the cockroaches, and rather curiously, tree-frogs are also enemies of this pest. Perhaps somebody will devise a means some time of raising tree-frogs on a laboratory scale and make a fortune disposing of them for the purpose of freeing pest-infected localities.

These insects, in common with other insects, are not capable of standing repeated freezing and thawing. I was told of an instance in which one concern considerably reduced the infection of cockroaches by this method. They obtained a report from the Weather Bureau as to when an extremely cold period was coming on, and then, shutting off all the water, and otherwise protecting themselves, opened the windows for over the week-end. The result was said to be quite fatal to those insects.

Repellents or poisons are frequently employed, fluoride, borax or phosphorous poisons being sometimes recommended. Certain other materials for treatment I will discuss or mention in conjunction with the other insects. Trapping methods are used at times.

The cereal-moth is another type of insect which some times does damage, starch shipments and other cereal products being infected by the larva or worm stage of the moths, with at least disagreeable results, if not too much damage. Para-dichlor-benzene placed in the covered bins containing the infected cereals has been used with success to get rid of the pest.

Then we come to the question of clothes-moths and carpet-bettles. The extent of damage done by clothes-moths and carpet-beetles, I think we are well aware of; they are very destructive in certain places when the infection is once obtained.

The food materials of these two types, the clothes-moths and the carpet-bettles, are very much the same. They have a great liking for protein matter of different characters, particularly wood fibers, or articles made from them, ordinary types of hair, or objects made of bristles, silk, feathers and furs. They also are said to infest untreated hides as well as to thrive on dead insects, beef, meal, and casein. Some people who develop or grow the insects for laboratory purposes use casein, raw wool, or moist feathers as a food material.

The destruction caused by the moths, of course, is a result of actual eating. They are not satisfied usually to begin at one point in the fabric and continue through the lot in due order, but will migrate around from one spot to another, eating actual holes in the fabric or destroying the fuzz on top, or, in the case of piled fabrics, destroying the pile, and with fur objects taking off the hair from the hide.

The life cycles of clothes-moths and carpet-beetles are much the same; that is to say, there are four different stages: the egg stage; the larva stage or the worm stage; the pupa stage or the chrysalis; and the adult.

In the case of clothes-moths, the eggs are said to be laid either singly or in groups among the folds of the cloth. In the case of loose fibrous materials, the eggs are placed rather deeply in the fibers, so that they are held securely; but on the hard worsted and similar fabrics, they are laid on the surfaces, from which they can be removed by brushing. The eggs are more or less brittle and quite easily damaged by agitation.

The hatching of the egg depends upon the conditions of temperature, varying anywhere from four to eight days up to three weeks. The larva stage or worm stage is the only stage in which damage is done to material, and the particular aim at destruction then is to prevent the larva stage from being reached, or else making it of a short duration. The larvae, as a rule, eat very rapidly in proper conditions of temperature, humidity and darkness. If temperature conditions are not right, in other words, if the room or place is cold, they can lie dormant without eating for periods of up to eight or ten months, and then, with the return of favorable conditions, start in again on their activities. This habit, of course, is of importance particularly in connection with the cold storage method of protecting the fabrics.

After the larva period has gone to its completion, the insect usually spins a cocoon of one sort or another and enters the pupa stage. This is entirely a resting stage, during which transition from the worm to the adult miller or moth [or to the carpet-beetle in the case of the carpet-beetle larva] goes on.

In connection with the laboratory growth of these organisms (once in a while we are so desirous of having moths around that we try to raise them in the laboratory), it seems to be difficult to have them increase when you want them to and so easy to have them grow when you do not want them to. If, however, you can control the condition of temperature and humidity so that you will have rather a reasonably warm place with fair conditions of moisture, along with the food, the organisms will grow. The absence of chemical fumes in the air is very

desirable. After spending about a year trying to get organisms to grow in the ordinary laboratory regions we have finally succeeded in getting a good crop by having a bunch of woolen rags left in the basement of the school, where, after a period of a few months, the increase in the organisms was quite sufficient for our purposes of testing.

I think, therefore, if anybody does desire to raise them, if they have plenty of time and if they will select some such place as a basement corner, rather dark and humid and not too cold, they will get very reasonable results.

As to the control of these types of moths (the carpet-beetles and ordinary clothes-moths), one method or one means is the prevention of infection. It so happens that in the normal process of of textile work the fabrics are continually sterilized by the dry heat and the mechanical agitation and thus cleared of the moths. If they can be kept clean by careful packing, then the infecion will be kept out and the danger reduced to a minimum, particularly if frequent and reasonable inspection is given the stored fabrics.

If a region or storehouse has become infected, various methods of fumigation can be employed. The following methods are said to be serviceable as well for cockroach elimination: If the place is not too large and the number of people around is not too great, hydrocyanic acid gas can be used with satisfaction. (See U. S. Department of Agriculture, Farmers' Bulletin No. 699.) It is, of course, a dangerous thing to use, but it has been frequently employed with good results for many insect and vermin types, under carefully controlled supervision.

If the containers are reasonably small and tight—small chests, closets or small rooms (as in domestic storage)—carbon bisulphide or carbon tetrachloride is said to give good results as sterlizing insecticide material for these moths. It seems interesting that formaldehyde vapors apparently do not produce results; while formaldehyde is a good disinfectant for bacteria, it apparently has little or no effect on many of the insects.

Cold storage is another method; that is, a reduction of temperature. In this connection it is interesting to note that what is necessary is not so much a single exposure to cold temperature as an alternation of cold, warming up, and then rechilling; that is what is effective. In other words, one practice which is said to be employed in cold storage works is to chill the material, after reasonable cleaning, to about 18 deg. Fahr., then to warm it up to around 50 deg. Fahr., and then to cool again and hold at 40 or 42 during the period of storage. It is said that after this treatment the moths will either be destroyed or else will be held in the dormant stage. Destruction is quite common, but occasionally a few of the organisms are left in a dormant state and they may come to life again, or become active upon removal from cold storage. But lowering of the temperature and storage in a cold place will very surely retard the damage caused by these methods and reduce it considerably.

One case was brought to my attention in which a mill having wool in storage (raw wool) seemed to control the infection very considerably when it built a well lighted and ventilated storehouse to replace a dark and dismal place. Naturally, they used up the infected wool as rapidly as possible. By that means the infection was kept down.

Another method of control which is used to advantage, and one perhaps with which more of the mill men are in direct connection, is the use of repellents and poisons. There are certain substances, particularly naphthalene or para-dichlor benzene, which are said to give very good results.

If you can get the material into a reasonably tight container the gases which come from the evaporation of the naphthalene or para-dichlor benzene seem to have quite a strong action on the moths. The concentration, of course, is quite important. In our experiments at the Lowell Textile School we use ordinary screw-top ointment pots and the concentration, of course, is very great there. Each of these materials, in other words, if used under favorable conditions, is ideal as a repellent and poison; the results we have obtained are certainly quite evident, the larvae being quiet after a very few hours' exposure. When they are taken out after a reasonably short exposure and put into other clean containers, they do not seem to go back to activity but shrivel and dry up.

Naphthalene and para-dichlor benzene appear to be quite commonly used in commercial moth-preventives, used either in solid form, compressed cakes or pellets, or in solution in a proper solvent. Sometimes the solvent itself has an immediate disinfecting or insecticidal value, the naphthalene or para-dichlor benzene having a more lasting repellent and poisoning action. The rate of evaporation of these materials apparently is quite low.

Another type of poison, which apparently depends upon the eating and therefore acts on the digestive tract, is sodium fluorid and other materials perhaps containing fluorides, which are dissolved in water and sprayed upon the cloth before going into storage. This material, a sample of which we have, apparently did not act as a repellent. I exposed moths to the action of the dry material, not sprayed upon the goods, but simply sprinkled on top of layers of cloth, with the organisms on bottom layers. It did not act in the same

manner as para-dichlor benzene; in other words, it did not act as a repellent and evaporating poison. Apparently, that material will have to be dissolved and eaten by the insects in order to be effective.

These various types of insects, then, apparently do cause considerable trouble to the manufacturers and to the consumers of materials, the particular time of danger being, of course, in case of storage or long-distance transportation where immediate supervision is not at hand.

If I might mention a few instances in connection with the danger of bacteria and mildew, I might call your attention, first, to the question of iron bacteria. It seems that there are several types of micro-organisms, very minute organism, of a botanical or vegetable nature, which have the ability to extract the iron from its organic compounds found in water. Occasionally the concentration of these organisms and the accumulation of iron as an oxide in the gelatinous sheath or the bodies of these materials is enough to cause trouble. Ellis in his book bearing the title "Iron Bacteria" has a chapter devoted to the practical damage which sometimes comes from this source, and he mentions actual cases of damage to piping, where the water came from contaminated reservoirs and the organisms in that water acted on the iron pipe, first clogging the pipe, thereby reducing its carrying capacity, and later actually pitting, corroding and causing the destruction of the pipes themselves.

FIG. 1.—*Photomicrograph of Normal Cotton Cloth*

I think we have all seen the infection of these bacteria in the more or less stagnant waterpools along the roadside. Perhaps some of you have seen small reservoirs in country districts which have been infected, of which you will speak in the discussion following.

Bacteria are important in connection with the health of employees. There are two very serious diseases which come as a result of bacterial infection. One is anthrax. The other is a special type of infection which the people in mills may have more direct connection with. It happens at times that employees have to dip their hands into a common bath of some kind of material, an oily substance or something else, which is not disinfected, and it is possible that one person may be infected and the infection (probably a skin disease) will spread to other employees who are dipping their hands into the same bath. The United States Public Health records have instances of that having happened.

The damage to lumber and underpinning of buildings, caused by molds, is well known to you.

Coming more directly to the question of fibrous materials employed in textiles, in connection with retting or soaking of the fiber, particularly flax and perhaps jute, bacteria and mold action is present. The process has to be carefully watched, otherwise the action will go too far and the flax fiber itself will be destroyed.

It is interesting to note how quickly textile material in contact with moist ground in a warm and humid atmosphere will be affected. I have in mind as an example florists' material. I know certain florists who had the habit of leaving balls of string around on the ground and beds of hothouses. In a very short time that string would be entirely rotted. I have a sample of such a string here, which shows that the strength of the material is entirely gone through the action of the micro-organisms on the string or fiber. This piece of string having ordinarily a strength sufficient to hold fifty or one hundred pounds, now can be pulled apart without any particular trouble.

This same type of trouble is experienced in canvas tenting material or anything else like that which is exposed to that condition.

Raw cotton is another type of material which is liable to be damaged by bacteria and mildew. It is said to occur quite frequently in raw cotton either in the bale or as unbleached yarn or fabric, if it is dampened in transit and has not been properly protected.

Bleached cotton is also liable to become infected. Of course, in the normal manufacturing processes the cloth is carried from one step to another so rapidly that ordinarily there is no time for any serious damage to be done, but in storage or transportation it may be affected, with serious results. The presence of starch or other food material in bleached cotton goods aids and favors mildew growth.

It may be that somebody has had experience with the resistance or lack of resistance of artificial silk to mildew. We have samples at the Lowell Textile School in the incubator, but as yet the result is not very positive.

Raw wool is liable to become affected by bacteria and mildew action. I understand that quite frequently wool bales coming from Australia or other places, which have been dampened by sea water and presumably other moisture, are considerably damaged and ruined by this action.

Woven wool perhaps is a little more resistant to mildew than vegetable materials, but at times even that is rotted.

The conditions for growth of bacteria and mildew are somewhat the same as for the insects. In other words, proper moisture, temperature and food are essential. Of course, different organisms require different degrees of moisture. Dry rot, for example, on lumber can grow in a minimum amount of moisture perhaps, whereas some types of molds grow well or most rapidly under water. But moisture is an essentian condition, and the lack of moisture or drying of the materials is one of the effective means of retarding the spread of the infection.

Temperature also is a controlling factor. The warmer the temperature, within reason, the more rapidly will these things grow. It is surprising how fast mildew will grow in the laboratory tests, a few hours, or overnight being sufficient to give a very positive and rapid accumulation of the material. Darkness, as a rule, or diminished light, is another condition which favors mildew growth and the opposite of it has a retarding action. The question of food material, however, is most important. Without the proper food material, the development may be possible but slow. When food material is favorable, the growth will be very rapid up to a certain point, beyond which it seems to go into a resting stage.

Another interesting feature of these materials is the fact that they can enter a resistant or resting stage; in other words, a spore stage. The vegetative or growing types of both organisms are reasonably easy to destroy. The resistant or spore stage requires a more severe treatment.

In one of the experiments which we conducted to investigate the presence of molds and bacteria in books, it was found that the spores of molds were still present in books from the subterranean regions of an old second-hand book store; those books had been there unopened for a considerable period, yet on bringing them into the laboratory and giving them suitable food and warmth they developed very nicely.

Occasionally in the laboratory it is very desirable to give a laboratory test to show the presence of infection. It is safe to assume, of course, that all material exposed to air is infected, but occasionally it may be desired to show whether spots or stains on the fabric are due to mildew or other cause. If these black spots are due to the spores of mildew and they have not been sterilized, then it is possible at times to arrive at some conclusion by a growing test, by taking the spotted area, placing it under sterile conditions with a sterile medium (such as Raulin's solution), then incubating and examining it frequently. If the black spot is due to mildew, the spores of mildew, it is reasonable to assume that the propagation of mildew from that spotted area will be rather rapid and by

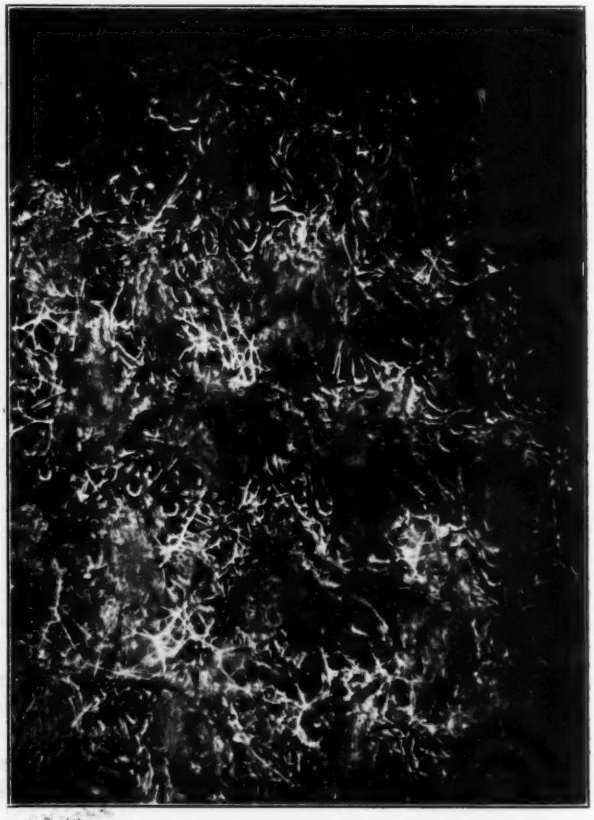

FIG. 2.—*Same Cloth As in Fig.* 1 *After It Had Developed Pronounced Growth of Mildew*

watching it closely and at frequent intervals the development of mildew in a concentrated form from that spot may often be observed.

These remarks constitute the main points of my introduction of the question for your further discussion. It might be interesting to hear of individual unusual instances of infection, or to obtain some idea as to the actual extent and frequency that infection occurs in manufacturing processes, in consumption or in transportation. Any particular effects which are capable of being observed after dyeing or finishing, which are due to previous infections of mildew, will be interesting; any innovations as to methods or materials for control of these organisms and any particular points which might be suitable for further investigation, I think, could be well brought in.

I thank you. (Applause.)

Discussion

President Olney—This subject, I believe, is far more important than we ordinarily think. We have manufacturing establishments which for many months, perhaps years, do not anticipate any trouble from these sources, but when it does come it is usually a very serious matter and it sometimes takes quite a while to locate it and eradicate it. This is particularly true in regard to molds and fungus growths, and we should like to have a good discussion of this subject. As Mr. Johnson says, if any of you have had special experience along this line we wish you would give us the benefit of it, and also ask any questions that you have on your mind; I am sure Mr. Johnson will be glad to answer them.

Mr. Milliken—Yesterday I had the privilege of going through one of the largest firms in this city. They have had considerable trouble with cockroaches; they have gone into a new building, and they were simply infested with them. I was talking to the chief chemist who is a friend of mine and he said he was using a powder composed of any fluoride (he said it didn't make any difference what kind of fluoride) with the addition of some adhesive material, and he said it was absolutely effective; he said he had eradicated the trouble in about a week's time. He went over the plant and simply eradicated the whole thing.

President Olney—That is valuable information.

C. E. Mullin—That has been pretty thoroughly worked out by the Department of Agriculture. Sodium fluoride is very effective in that way. It doesn't necessarily have to be an adhesive; gypsum may be added, in proportions of about fifty-fifty, and it will give very good results.

H. C. Roberts—Mr. Chairman, some time ago we had an experience with cockroaches; they would take the linen tags that we put on the pieces and chew the starch and sizing material entirely out of them until we couldn't tell what the piece was; they would just leave the film of gauze that the tag was made on. I was talking about that with the man who rids Armour & Co. of their rats and insects and he said that borax was very effective. He said that wouldn't kill them but they just didn't like to be where borax was present. So we sprayed the storeroom where the goods were previous to going into the dyehouse with powdered borax, around the cracks in the floors, and we had no further trouble from that score.

We took the matter up with the tag manufacturers and asked them if they could use borax in the sizing material of the tag and they said they could, and they did so. They were quite pleased with the results they got in the appearance of the tag itself because it made the tag glossier and when it was written on with ink it made the ink absorb better; and when we used those tags that were treated with borax we had no trouble from them. There were cockroaches there but they didn't seem to bother the tag, and that was the only thing we were interested in keeping them away from.

President Olney—Has anyone had special experience with molds or fungus growths? The question was raised about artificial silk. Has anyone had any experience with that?

H. D. Clayton—We had an experience about seven years ago with the iron form of bacteria that Mr. Johnson spoke about and had the same thing happen again this year. They got into our water supply and bleachery and it wasn't discovered until it developed in the chemic. Iron stains appeared on the cloth in the chemic department.

President Olney—Are there any further remarks?

Mr. Walter—I would like to ask Mr. Johnson if he knows of any particular type of mildew or mold which has a specific action on cotton cloth. There are a large number of molds but there are certain ones, I think, which have more destructive action than others and I would like to know if Mr. Johnson can tell me the names of some of those.

Mr. Johnson—I do not have in mind the specific names of different types, but it seems to be true that the group capable of destroying cellulose is rather large, particularly after these organisms once get a start. There are certain bacteria which will act even on filter paper, under proper conditions. There are quite a few types, I believe, which will act on filter paper in the presence of air and therefore on plain cotton, of course, in the presence of air; other types of bacteria will act on cotton in the absence of air, given methane or hydrogen fermentations, as they are called. Practically any mildew, I think, which will act on starchy material, if given time, will penetrate into the cellulose itself. There are very likely types which will grow with reasonable speed on pure cellulose but I can't give you the specific names of any.

Mr. Walter—Do you happen to know whether the Rhizopus negri has any particular action on cotton?

Mr. Johnson—I couldn't say.

Mr. Walter—Do you think that the weakening action of the mold is due to bacteria which produce oxalic acid and that the oxalic acid has the destructive action?

Mr. Johnson—I had it in mind that very probably the weakening action was due to enzyme action, that is to some sort of enzyme materials produced by the organisms themselves. It is very common, I think, for bacteria and mildew to be associated and it is very likely that certain types of bacteria will produce products which will digest the material and then it can be used by the mildew.

I have a rather certain feeling that mildews can act in the absence of bacteria, or in the practical absence of them, by their own digestive fluids or enzymes. It seems that in certain molds the form of the cell varies as it goes into the fabric, as compared with the form of the vegetative cells on the surface of the fabric; there is a little rearrangement or change in shape, not exactly root formation, but yet a change in shape which probably facilitates the secretion of some digestive fluid or enzyme that brings about the action. That would be my idea of it at the present time.

President Olney—Are there any further remarks or questions?

Mr. Mullin—I would like to ask if anybody has had any experience with silver fish, which are probably more destructive to sizing and so forth than to the fiber itself although I do believe they affect cellulose to some extent. Sodium fluoride doesn't seem to be as effective on that as on the cockroaches. That is an insect.

Mr. Johnson—I should think materials like formaldehyde would act in those cases.

Mr. Mullin—They infect the laboratory; it is pretty hard to get formaldehyde around there.

Mr. Johnson—In some instances I believe that a trace of copper material, copper salts, will be effective, especially for mildew. That is one method of treating materials to prevent damage from these organisms.

Mr. Mullin—They damage books very seriously; they eat the surface of the paper off; they very seldom penetrate through the surface, but they eat the surface off.

Mr. Johnson—Would it be possible to incorporate small quantities of copper salts—

Mr. Mullin—After you have the book, it is pretty hard to do that.

C. W. Lotte—We received some piece goods, artificial silk, and when we put them in the dye bath the artificial silk disappeared and the cotton remained. That was undoubtedly due to mildew from dampness, as it was only the outside layers on the inside of the bale which were affected.

Mr. Milliken—Did you have any alkali in it?

Mr. Lotte—Yes; they were dyed in an alkaline bath, but the alkaline was not very strong. I should say that there was not over one per cent solution of soda in it.

Mr. Johnson—May not the question of moisture have been an important factor in that case you mention?

Mr. Lotte—I think the bacteria got into the original condition of the material.

Mr. Johnson—While these are growing there is liable to be an accumulation of slimy dampness; might that have had some effect on the artificial silk?

Mr. Lotte—Possibly.

Mr. Milliken—I find that the artificial silk game is rather uncertain at the present time. Sometimes you are liable to get a half piece with some kind of artificial silk and another half with another kind of artificial silk, and on some you cannot use alkali in any way, shape or form, and others can stand it all right.

Mr. Bohl—I have had experience with acid colors where the colors used would turn reddish with alkali, and that was due to the action of the mold on the color. It would turn the same as an alkali does. Do these organisms produce alkaline materials?

Mr. Johnson—It is my belief that most mildew action is associated with an acid reaction but I should say that it would perhaps depend on the type of food material present. Most of the laboratory media used for growing the organisms have an acid reaction.

Mr. Bohl—In this case, the condition of the material was a little acid, I should say.

Mr. Carter—I should like to ask Mr. Johnson if he has made any investigation of the Eulan treatment of wool. A very interesting article has been published, with some illustrations showing wool which was treated with Eulan and some which was not treated with it, and the material which was treated with the Eulan solution was perfectly all right.

Mr. Johnson—I think we received a copy of that same article.

Mr. Carter—It was published about a year ago.

Mr. Johnson—We have been having quite a struggle to get enough insects to carry on our regular tests, and so have not any very positive results to mention concerning this preventive.

Mr. Carter—I believe there is one concern in New York that is in the business altogether of proofing woolen goods; I have forgotten the name of it.

Mr. Johnson—I have received two or three advertisements from companies located in New York, along that same line.

Mr. Mullin—I have seen some very good results in breeding moths on damp feathers in an incubator.

Mr. Johnson—That is interesting. I believe the Department of Agriculture in Washington also uses casein

They will apparently grow on quite a few different types of substances.

E. A. Widmann—I want to say a word in regard to Eulan.

It has been pointed out here that the Department of Agriculture is advocating the use of fluoride to destroy roaches. As I understand the theory, fluoride has an effect on silicates, and the shells of these roaches and other insects are supposed to be partly silicate, although not all silicate, so that the action of the fluoride is on the hard matter of the insect or any part of it that is of silicate. It may be that this silver insect which the gentleman mentioned a few minutes ago is a soft bacterium and hasn't any silicate of any kind; consequently, the fluorides have no effect on it.

As I understand the Eulan principle, one of the principal agents in it is also of a fluoride nature. But ordinary sodium fluoride cannot be used successfully because it is soluble, and if the wool material treated becomes wet or is subject to moisture or water, it will readily wash off.

With regard to the Eulan principle, while the fluorides are in such form that they combine with the wool, simply spraying it on the wool material will not cover every fiber properly, and in order to get the full effect of Eulan on a fiber, it must be subjected to treatment of some acid, preferably picric acid which is generally employed. I understand further that formic acid is present in a great many moths. It is present in the ant, the mosquito, and probably in the moth, and the formic acid in the moth splits up the sodium fluoride and then the presic acid acts on the silicate in the moth or the caterpillar, and that is the thing that does the trick. But it is absolutely necessary to give it a prolonged and thorough treatment of a substance on the type of Eulan in order to get the benefit of it.

President Olney—I think we had better pass along because we must reserve time for discussion of these other subjects.

We have a rather unfortunate situation with regard to the next number on the program. Through some misunderstanding, an entirely different subject was assigned to the speaker than he felt qualified to speak upon. We understand that his subject should have been, "The Nomenclature of Color Measurements," or a subject along that line; and to make matters still worse, through transferrence of the name back and forth, we have printed his name wrong on the program. It should have been Erwin G. Priest instead of Edwin G. Priest. At the last moment Mr. Priest found he would be unable to adapt himself to this decided change in subject, and he isn't here to-day. I wish to assume a very large part of the responsibility in regard to these mistakes. I have written a letter to Mr. Priest apologizing, and I just wished to explain that it is on account of the change in subject that he isn't here to-day.

The next paper is "Naphthol A S and B S Colors and Their Application." Dr. Rose was to have presented this paper in person, but unfortunately he is suffering with influenza and unable to be here. He has written a letter expressing his deep regrets. Mr. H. S. Thompson is going to present the paper. I think many of you know Mr. Thompson already. You saw and heard him last evening, only perhaps under slightly different conditions than at present. (Applause and Laughter.)

Mr. Thompson—Mr. President, Ladies and Gentlemen: I am sure this meeting is extremely unfortunate in not having Dr. Rose here to present his own paper. However, I will do the best I can with it.

. . . Mr. Thompson then presented Dr. Rose's prepared paper, entitled "The Development of Ice Colors," which is published herewith.

THE DEVELOPMENT OF ICE COLORS

By Dr. R. E. Rose

E. I. du Pont de Nemours & Co.

When artificial colors began to displace natural products one of the chief efforts was to find a substitute for Alizarine Red, because this dyestuff was so hard to apply and because it was in great demand on account of its beautiful shade and very great fastness. Of course, the synthesis of alizarine made it possible to produce the dyestuff artificially, but it did not supply the substitute. The first indication that something might be achieved in this direction was in 1880, when it was found that paranitraniline coupled with beta naphthol gave a very bright red. However, this red was too insoluble to be of any value as a dyestuff and the only method of application was that of producing it within and upon the fiber by impregnating with beta naphthol and then introducing the impregnated goods into a solution of diazotized paranitraniline. The combination gave a very bright shade of red which could be produced very cheaply, but it had several disadvantages.

The molecular weight of the compound is small, as dyestuffs go, and it contains no acid other than the hydroxyl of the naphthol. On that account it possesses a comparatively low boiling point, sufficiently low to make it possible to sublime the color off the cloth. Also, the fastness of Para Red to washing is not extraordinarily good and its fastness to light is comparatively poor. All that could be said, then, was that the discovery made it possible to produce a cheap red which could be offered to those people who did not want to pay for Turkey Red.

In 1888 Green made the next advance when he produced Primuline and showed that this canary-yellow dyestuff, which had no particular fastness, could be developed by using beta naphthol to give a scarlet which was very much better than Para Red but still

had no fastness to light. Primuline really belongs in the class of developed colors, and is not properly classified with the compounds which we are discussing, but still its introduction showing the possibility of getting nearer the Alizarine Red with azo dyestuffs made the efforts of the chemists of the dye companies still more active in trying to find what they wanted.

If we go back to the typical Para Red dyeing we find that it suffers from a serious defect. Beta naphthol has practically no affinity for the fiber, and therefore it is impossible to develop the color without first drying the impregnated fiber. This is wasteful and, in addition, the low affinity means that a good deal of the color is developed on the outside of the fiber and on that account it is difficult to obtain a result which will not crock.

The ideal ice color then would be one which had the following characteristics:

The first component should have a comparatively high affinity for cotton. It should exhaust fairly well and it should be possible to ignore the small amount left in the dye bath when the goods were properly hydroextracted. In addition, in order to compete with the prototype, Alizarine Red, the resultant coupling should be very brilliant and should possess very great fastness to washing, to light and to chlorine. The requirements seemed to be beyond any that could be realized with an azo color.

If we take the first one, affinity for the fiber, it is clear that if we were to improve this, even though we succeeded in doing nothing else, we would have something far better than Para Red. Now, affinity for the fiber is strictly a function of the degree of colloidal dispersion; beta naphthol does not go onto the fiber, because its solution in caustic is too much of a true solution; it is not colloidal enough. To increase the colloidal characteristics the simplest plan would be to increase the molecular magnitude of the naphthol. We must do this without changing the characteristic red and therefore we must be very cautious in the kind of substituent we choose. It was known that beta hydroxy naphthoic acid gave reds, but these reds, owing to the presence of the carboxyl, were all to fugitive to washing; also the acid had no more affinity for the fiber than beta naphthol. Putting other substituents into the naphthol nucleus gave poor results, and it occurred to the chemists of the Griesheim Electron Company to increase the molecular magnitude by adding on to the carboxyl group of beta hydroxy naphthoic acid. It was necessary that the group introduced should remain there permanently, and that it should decrease the solubility of the compound while increasing its molecular weight. It is not easy to attached to a carboxyl group anything which will remain there. Salts are too much ionized and are sensitive to alkalies; esters are also sensitive to alkalies and even to water, regenerating the free acid. Acid amides are somewhat better, but these also undergo hydrolysis; besides, an introduction of an amino group does not increase the molecular weight of the compound. Its only advantage would be that it would render it less soluble in alkali. These difficulties were overcome by making a substituted amide. When aniline is caused to react with beta hydroxy naphthoic acid in the presence of phosphorus, oxychloride (the aniline salt which is first formed) loses a molecule of water to give the anilid, and this is remarkably fast to saponifying agencies. This compound is sufficiently colloidal to have a real affinity for cotton, and therefore affords a very fair solution of the first difficulty which it is necessary to surmount.

The astonishing part is that at the same time it solves the others, because, when coupled with metanitroparatoluidin, Naphthol AS, as the anilid of beta hydroxy naphthoic acid was christened for the trade, yields very brilliant reds which are not alone fast to heat, light and washing, but are fast even to chlorine. This was the most astonishing piece of good fortune. It seemed utterly impossible to expect as much in one compound when you consider that we were trying to get at three entirely distinct properties at once; that is, properties depending on different molecular characteristics. With this remarkable achievement, the next few years found the Griesheim Electron Company endeavoring to increase their range of these Naphthol AS colors by modifying the base on the one hand and the naphthol on the other. It was found, for instance, that Naphthol AS coupled with diazotized para nitro ortho toluidine gave a bluer shade of red; with para nitraniline still another shade; with dianisidine a blue; with alpha naphthylamine a claret. Also, it was found that by using m-nitro-anilin a naphthol producing bluer reds could be made—the BS brand.

All this was shortly before the war. Perfecting the methods of manufacture of the products and the necessity of educating the public to their astonishing fastness meant a comparatively slow development. It was very hard to persuade a dyer that any azo color could give him a red which he could use for awning stripes to take the place of Turkey Red. He evidenced a natural reluctance to believe anything of the kind.

It should be stated quite candidly that the line was not as impressive as it might sound. The blue with dianisidine was very fast to light when after-treated with copper, but it was extremely difficult to handle and get uniform results. It was easy to get a good blue, but not at all easy to get the same blue, and on that account this shade in the line did not meet with

much success. Also, the claret was only fair in fastness, and the pinks, which could be made by a very light dyeing of the reds, were not any faster to light than the vat pinks of the thio indigo series, and could not, therefore, compete with alizarine. They were, however, very beautiful pinks and very cheap because of the great intensity of the color.

There was no yellow in the line, and it is quite easy to see the difficulty of producing such a hue, because if we couple any kind of benzene rest with naphthol a product is formed which is orange rather than yellow because of the complexity of the molecule; and since we cannot diazotize and use for development anything simpler than aniline, we cannot get beyond the orange. In addition, there was no black in the line, because the molecular complexity was not sufficient to push the color absorption to the intensity required for a black.

In the last couple of years the Griesheim Electron Company has been able to announce further remarkable achievements in this series of colors. They now have six naphthols, which are the following:

Naphthol As is B-Hydroxynaphthoic Acid Anilide.
Naphthol AS-BS (formerly called BS or AN) is M-Nitroanilide of B-Hydroxynaphthoic Acid.
Naphthol AS-BO is X-Naphthalide of B-Hydroxynaphthoic Acid.
Naphthol AS-RL is P-Anisidide of B-Hydroxynaphthoic Acid.
Naphthol AS-SW is B-Naphthalide of B-Hydroxynaphthoic Acid.
Naphthol AS-G is Diaceto Acetic Tolidide.

By using bases already containing a color group—for instance, amino azo naphthol derivatives and one of the naphthols, AS-SW—it was found possible to increase the complexity of the color to a point which would give a very good blue black. This blue black is remarkable in being fast to chlorine and very fast to light. Its only disadvantage as against a vat black is that it is not so fast to washing. It runs quite a little into the white in a severe wash test.

The effort to produce a yellow was carried out in a very ingenious and very thoroughly scientific way and has led to the discovery of a new type of base. The sodium salts of carboxylic acids of sulphonic acids, sufficiently simple in structure to give yellows, are all too soluble in water to allow of their being used as a prepare for development. However, in order to have a comparatively insoluble molecule in solution it is necessary to have some kind of acidic group in it, since the solution for the coupling should be neutral or slightly alkaline. We have seen that naphthol is already too intensely colored; therefore the search was made for a substance faintly acid and with an affinity for the fiber, yet possessing the arrangement of chromofores which would produce very little color, but intense enough to produce a yellow after coupling.

Stop for a moment to think of the difficulty of this problem, and then realize what an ingenious solution was effected and how essentially it belongs in the province of the highly trained chemist. Acids were not suitable, because compounds containing acid groups wash out too much. Naphthols gave oranges, phenols had no affinity for the fiber, yet something faintly acid had to be found.

Aceto acetic ester is a compound which has always been a great fascination to the organic chemist. It enabled him to learn a very great deal about the structure and the behavior of organic molecules, and it has also enabled him to make a number of compounds which he would have found beyond his reach without this very reactive substance. Aceto acetic ester has no free carboxyl. It has no phenolic group, but it does dissolve in caustic soda and the reason is that in the presence of alkali the molecule arranges itself to form a hydroxyl group which is remotely similar to that of an organic acid. Acetoacetic ester is used in dyestuff synthesis in making the compounds of the fast light yellow series, such as Pontacyl Light Yellow 3G, which are derived from pyazolones. Acetoacetic ester itself is of no value, because it decomposes too readily. A pyrazolone is not suitable for the present purpose, therefore the German chemists condensed acetoacetic ester with derivatives of diphenyl, such as benzidine and tolidin. They found that these compounds were soluble in weak caustic and, owing to the presence of the diphenyl group, they possessed affinity for the fiber, and, finally, that they coupled quite readily with diazotized organic bases which, when properly chosen, gave a vivid yellow. Moreover, this vivid yellow possessed all the characteristics of the best ice colors of the series. It is fast to bleach and fast to light. It is a remarkable example of the triumph of the organic chemist.

Mention has not been made of other weaknesses of the naphthol colors in their competition with alizarine and with vat dyes. They are not fast to kier bleach under pressure, and this interfered with their use in toweling and in other such articles. Now, by a considerable modification of the base it has been possible to produce colors which are very creditably fast to this severe test. We cannot say that they are yet perfect, except perhaps the yellow according to the description of the manufacture, but some of them are so nearly so that there seems no reason to suppose this line of attack will meet failure.

I have emphasized the chemical side of this chapter

in the development of dyestuffs and I have done so intentionally, because I think it is well for all of us to realize how much the chemist does for the dyer when he understands the physics and chemistry of the dyeing process. It is equally true that the dyer gains very much by an equal knowledge of these processes, because he can then meet the difficulties which arise in the course of his daily duties and master them much better than he could if he merely took the chemist's product and worked with it.

Just before giving this paper its final form I find that this group of colors illustrates once more the truth of the importance of the chemist to the dyer. It was stated earlier in the paper that the blue made by coupling diazotized dianisidine with Naphthol AS was extremely unreliable, varying anywhere from a green blue to a navy under apparently identical conditions. This, of course, could only mean that a series of compounds is formed instead of one, and the chemist was able to show that the reason is that the coupling is extremely sensitive to the hydrogen ion concentration of the bath. Those of you who have worked with this color will remember that you were told to keep the diazotizing bath just barely acid. But obviously this is something which is very difficult to do when the goods going into the bath contained alkali from the impregnation. The chemist now advises the dyer to work in a neutral solution, a condition which he can adhere to if he has in his bath sodium bicarbonate and zinc bicarbonate. The sodium bicarbonate converts the caustic of the padded goods into sodium carbonate. This would be too alkaline; but it reacts at once with the zinc bicarbonate, giving insoluble zinc carbonate and regenerating sodium bicarbonate. If this works (we have not yet had time to try it) it is a very elegant example of chemistry as applied to the dye bath. Details will be found in the last issue of the Textil Berichte.

The function of the dyestuffs chemist and the dyer are two sections of a continuous line, and the further the knowledge of each extends along the line the better. Naturally, the dyer will never be in a position to discuss the intricacies of organic synthesis as they are at present understood in the research laboratory of the dyestuff manufacturer. If he were able to do so he would probably be in the laboratory rather than in the dyehouse. It is equally true that the dye works chemist cannot know the intricacies of dyeing processes without sacrificing more time than he has to dispose of, if he is to keep up with his extremely difficult main interest. But there is, I wish to emphasize, a median ground which should be covered by both.

The following table gives some of the prominent colors of this series, with their chemical equivalents:

Naphthol AS is B-Hydroxynaphthoic Acid Anilide.
Naphthol AS-BS (formerly BS or AN) is M-Nitroanilide of B-Hydroxynaphthoic Acid.
Naphthol AS-BO is X-Naphthalide of B-Hydroxynaphthoic Acid.
Naphthol AS-RL is P-Anisidide of B-Hydroxynaphthoic Acid.
Naphthol AS-SW is B-Naphthalide of B-Hydroxynaphthoic Acid.
Naphthol AS-G is Diaceto Acetic Tolidide.
Fast Yellow G Base is O-Chloroaniline.
Fast Orange R Base (GrE) is M-Nitro-Aniline.
Fast Garnet B Base (GrE) is X-Naphthylamine.
Fast Garnet G Base (GrE) is O-Aminoazotoluene.
Fast Red B Base (GrE) is 5-Nitro-2-Aminoanisole.
Fast Red BB Base (GrE) is O-Anisidine.
Fast Red G Base (GrE) is 3-Nitro-4-Aminotoluene.
Fast Red GL Base (GrE) is 3-Nitro-4-Aminotoluene.
Fast Red 3GL Base (GrE) is 2-Nitro-4-Chloroaniline.
Fast Red 3GL Base Special (GrE) is 2-Nitro-4-Chloroaniline.
Fast Red R Base (GrE) is 4-Chloro-2-Aminoanisole.
Fast Red RL Base is 5-Nitro-2-Aminotoluene.
Fast Scarlet G Base (GrE) is 4-Nitro-2-Aminotoluene.
Fast Scarlet R Base (GrE) is 4-Nitro-2-Aminoanisole.
Fast Blue B Base is Dianisidine.
Fast Black LB Base is 2-Ethoxybenzene-Azo-X-Naphthylamine.

NOTE.—*See "The Identification of Insoluble Azo Colors on the Fiber and of Azo Pigments in Substance," by F. M. Rowe and C. Lewis, J. Soc. Dyers & Colorists,* 1924, *p.* 218.

Discussion

President Olney—We have all been very much interested in this clear and comprehensive presentation of the subject, and we also wish to thank Mr. Thompson for reading it so well. I am sure there must be some discussion on this subject. I am certain there are some here to-day who can answer questions in regard to the subject if you will ask them.

Mr. Lawrence—May I ask the speaker if he can tell me about how much of the zinc bicarbonate and sodium bicarbonate he used in the dissolved Naphthol AS?

E. P. Davidson—It is used in the development bath where the Naphthol AS is coupled with the diazotized dianisidine. I don't know exactly what the proportions are. We just got that information recently and haven't had time to work it out as yet.

President Olney—Are there any other questions? I

think Mr. Davidson is well qualified to answer any questions that you may have to ask on this subject.

Mr. Stewart—What is the name of that yellow, naphthol yellow?

Mr. Davidson—I think they call that Naphthol ASG, and it is coupled with Meta Nitro Aniline, Fast Orange-Yellow Base.

K. A. Brownell—There is a Yellow G Base that is used effectively.

Mr. Davidson—I didn't know it was being put out in liquid form; probably it is some new development.

Mr. Thompson—Dr. Rose has it here that Fast Yellow G Base is Ortho-Chloroaniline coupled with Beta-Tri-Aniline Hydroxynaphthoic. That is the chemical constitution of the development.

President Olney—Are they any other questions?

W. F. Haskell—May I ask if the use of sodium bicarbonate and zinc bicarbonate has any advantage over some of the practical agents, I mean, as Fast Red G Base?

Mr. Davidson—That is a question I really cannot answer. As I say, we just found out about this zinc bicarbonate process a few days ago and there hasn't been any work done on it at all as yet. We haven't had a chance to get to it. All we know about it is contained in the paper.

President Olney—If there are no further questions we will pass on to the next paper, "Mercerization of Cotton Piece Goods," by Mr. W. W. Chase.

. . . Mr. Chase presented his prepared paper, which is published below.

THE MERCERIZATION OF COTTON PIECE GOODS

By Winn W. Chase

This year may be properly called the twenty-fifth anniversary of practical mercerizing in this country. For that reason it seems a particularly fitting time to review the present status of this important finishing process.

Mr. Deady in a recent issue of the American Dyestuff Reporter has an excellent general article on the Mercerizing of Cotton Piece Goods (October 20, 1924). In this paper, therefore, I shall try to avoid so far as possible any repetition of the facts which he gives, but will endeavor to present the matter from a somewhat different angle.

The mercerizing of cotton is more than merely running cloth through an alkali solution, but it is in many respects a problem in chemical engineering. It is from the standpoint of chemistry and of engineering that we shall now consider this process.

Any chemical reaction may be said to have optimum conditions of time, temperature and concentration. This is true of the mercerization of cotton which is fundamentally a chemical reaction between cellulose and sodium hydroxide. Again, it is common knowledge that even when the optimum conditions for a given chemical reaction have been established in the laboratory, to devise methods for the proper economical operation of the process on the plant size scale usually requires considerable engineering skill.

Research

A large amount of research has been conducted on the mercerization of cotton and for practical purposes the action of alkalis on cellulose is fairly well understood. It has been shown that when caustic soda solution of a minimum concentration of 22 deg. Tw. is allowed to act upon cotton an unstable alkali cellulose is formed. This upon washing changes to a hydrated form of cellulose possessing an increased affinity for many classes of dyestuffs. If no tension is applied to the cotton during the treatment, the fibers shrink in length and gain in diameter, tensile strength and elasticity, but show negligible increase in luster.

If, however, the cotton is held under tension during the treatment with caustic and the subsequent washing, there occurs a reduction in the number of natural convolutions in the fiber, the fibers become straighter and more nearly parallel, and a permanent silky luster is obtained.

Experimenters working with single fibers have shown that the maximum shrinkage occurs with caustic solutions of about 45 deg. Tw., but in the practical mercerization of piece goods in the plant solutions of 52 deg. Tw. or slightly higher give the best results. Kirchbacher (J. C. I., 1911, p. 20) demonstrated that the greatest shrinkage occurs at low temperatures. For example, with caustic at 52 deg. Tw. at 35.6 deg. Fahr. there is a shrinkage of 22.7 per cent, at 64 deg. Fahr. a shrinkage of 21.2 per cent, while at 86 deg. Fahr. the shrinkage drops to 18.5 per cent. In practice, therefore, the trend has been to maintain as low a temperature as possible, and in many plants refrigerating apparatus has been installed with this purpose in mind. Recent investigations have shown that although three minutes is necessary to insure the maximum effect of mercerizing liquors the reaction is practically complete in one minute.

Additions to the Solution

Many suggestions have been made for additions of various chemicals to the caustic soda solution for the purpose of increasing luster. Among these are sodium sulphide, viscose, glue and alcohol; it is doubtful, however, whether any of the substances thus far advocated are of any great value. On the other hand, it has been shown definitely that impurities such as salt, soda ash, starch and the like have a deleterious effect and that the

maximum luster is obtained with caustic soda solution as free as possible from these impurities.

In adapting these findings to the mercerizing of cotton piece goods, if the best results are to be obtained the following points should be observed:

(1) The cloth should receive an even and thorough saturation with the mercerizing liquor.

(2) The caustic solution should be maintained at a constant strength of not less than 52 deg. Tw. and at a temperature not exceeding 65 deg. Fahr.

(3) The caustic should be free from impurities.

(4) The cloth should remain in contact with the concentrated alkali for at least one minute.

(5) The tension should be carefully controlled, avoiding an excess which will tear the goods and too little which will not only prevent the maximum luster, but will also make the goods liable to damage in the subsequent finishing process when being stretched to the required width.

(6) The cloth should be given sufficient washing while stretched to reduce the caustic remaining in the goods below the minimum mercerizing strength of 22 deg. Tw., thus preventing shrinkage when the tension is removed.

The usual method of mercerizing piece goods as practised in this country is to saturate the cloth with caustic in a three-bowl padder, next run it on to a 60-foot tenter frame equipped with overhead spray pipes where the cloth is stretched to its original width and the washing begun, and finally pass the goods through an open width washer or other apparatus to further remove the caustic.

If the cloth is run at a speed not exceeding 60 yards per minute, and if ordinary precautions are taken against mechanical damages, no great difficulties will be encountered in mercerizing with a range of this type.

When to Mercerize

There is considerable disagreement as to the proper place in sequence which mercerizing should occupy in relation to the finishing process as a whole. Mercerizing in the gray after singeing is preferred by some finishers because it is the cheapest method; others favor mercerizing after kier boiling and drying which produces a superior luster, but at an increased cost.

The following sequence to which I have seen no references in the literature, while only slightly greater in cost than mercerizing in the gray, gives results favorably comparable with any other method:

(1) Singe and desize in one operation.

(2) Wash, soap, wash with hot water, and rinse with cold water in a four-box open width washer.

(3) Mercerize.

(4) Boil in kiers.

The advantages of this method are:

(1) The starches and dextrines with which the gray cloth is sized are completely removed together with an appreciable amount of other impurities, thus making the fabric less resistant to the action of the caustic solution.

(2) The cloth is cold when it enters the mercerizing pad, thereby reducing the necessity for an expensive refrigeration system.

(3) The caustic is less contaminated with foreign matters than when mercerizing is done in the gray, thus giving a cleaner and more efficient mercerizing solution and reducing the difficulties of caustic purification.

(4) The goods entering the kiers have been freed of a considerable amount of impurities and at the same time are completely and evenly saturated with caustic, in that way aiding the subsequent boiling both as regards thoroughness of boil and saving of time.

(5) The caustic remaining in the cloth when it leaves the mercerizing range is not wasted as it is utilized in the kier boil.

In order to insure constant and economical operation of the mercerizing department the question of caustic supply and recovery requires careful consideration.

On the basis that one pound of caustic is required to mercerize four pounds of cotton the processing of a weekly yardage of three-quarters of a million yards of cloth will necessitate the use of about 40,000 pounds of caustic soda. Since the cost of the caustic used is the greatest item of expense in mercerizing, it is necessary from the standpoint of economy to install a caustic recovery system. Here again engineering skill comes into play, for to provide such a system requires dissolving and storage tanks, filters, evaporators, pumps, valves and pipes of the proper capacity and construction to satisfy all requirements.

Cost Specifications and Equipment

Following the flow of caustic through the processes of mercerizing and recovery we find that for a plant of the capacity and type designated to maintain a constant strength of 52 deg. Tw. in the padders it is necessary to feed into them during a 50-hour week 10,000 gallons of alkali solution at 76 deg. Tw. containing the equivalent of 40,000 pounds of solid caustic. To thoroughly wash the cloth before it leaves the range requires some 75,000 gallons of water. This wash water may be recovered at a strength of about 10 deg. Tw. and must be purified and concentrated. About 65,000 gallons of water are evaporated, leaving 10,000 gallons of concentrated solution at 69 deg. Tw. containing the equivalent of 30,000 pounds of solid caustic. The addition of 10,000 pounds of new caustic to this solution suffices to bring the concentration to 76 deg. Tw. and replace the loss from the system. About 75 per cent of the total caustic used is readily

recovered at a cost of 1 1-3 cents per pound, which nets a weekly saving of $500.

For a plant mercerizing 750,000 yards of cloth per week of 50 hours, there will be required five mercerizing ranges of the type previously mentioned, together with the necessary tanks, filters and evaporator comprising the caustic supply and recovery system. The most convenient layout for the mercerizing department is probably a one-story building with basement, all process machinery being on the main floor and so arranged that the cloth can enter the building at one end and after passing in a straight line over the ranges, leave the room at the other end. The complete caustic supply and recovery unit is located in the basement.

To operate this department a boss mercerizer is needed who can take charge of the processing and who is responsible for the quantity and quality of the work. Under his supervision are six workmen whose duties are to run the mercerizing ranges; three of these should be stationed at the front end of the machines and three at the back end.

To operate the caustic supply system two men will be required. Their duties are to operate the evaporator, dissolve new caustic, keep all tanks and filters clean, and maintain the mercerizing liquor at the proper strength and temperature.

In order that the boss mercerizer may devote his full time and attention to the processing of the cloth and at the same time insure the proper supervision of the caustic supply system it is advantageous to have this service considered as an entirely separate department functioning under the direct control of the plant chemist.

After any process has reached the plant scale the determination of costs is an important item. To calculate the cost of mercerizing it is only necessary to determine the total charges against the department for a given period and divide that sum by the yards of cloth possessed, the answer being the average cost per yard.

If the cost of the mercerizing department, including the buildings and equipment is $200,000, the weekly charges will be approximately as follows:

Labor and supervision	$ 450
Interest, depreciation and taxes	1,000
Maintenance, insurance, manufacturing expense, power, steam, etc.	450
Drugs, including cost of recovered caustic	600
	$2,500

With a production of 750,000 yards the average cost per yard is one-third of a cent.

In summary, then, it may be stated that the mercerizing action of caustic soda on cotton is fairly well understood and that the optimum conditions of time, temperature and concentration have been established. Methods and equipment for the treatment of piece goods have been developed so that cloth may be processed efficiently and cheaply and mercerizing is an important and growing process in textile finishing.

Discussion

President Olney—Is there any discussion of this paper? Mr. Chase has presented the subject of mercerizing in a very clear manner, and I am certain some of you have questions to ask him with regard to it.

Mr. Deady—I would like to ask the speaker if he had experienced any trouble in the form of resists in mercerized goods.

Mr. Chase—Of course, you are all running in to resist in finishing plants, but I should say that as a rule the resist is not due to the mercerizing but is much more likely to be due to the imperfections in the kier boil. There is no reason when you are treating goods in the open width why they shouldn't have a perfectly even treatment and thereby reduce the chance of getting resist of any sort.

Mr. Deady—What I had reference to was having them dry before getting the caustic completely washed out.

Mr. Chase—Of course, it is possible to get parts of the cloth air dried, as we call it, and in that case you will get resist, but with this method which we use we run directly into the kier and in that way do not have that difficulty. In plants where they mercerize after bleaching there is a great deal more chance for the goods to become air dried and thereby develop resist from having the caustic right in the goods.

Mr. Lawrence—Can you tell me if you get better results in your first spray pipes if you have the wash water at a boil or at 140 to 150, or somewhere around there?

Mr. Chase—This brings up another subject, a little different aspect of the subject.

I said that the necessity for caustic supply and recovery is evident. Well, it is when a large proportion of your work is mercerizing. When the proportion of goods that are mercerized is small as compared with those that are kier boiled, you don't need any elaborate caustic supply and recovery system, but even in that case you can do the same thing.

What we do is to take the wash water from the open width washer at the end of the range, collect that, and use that for the first washing on the tenter frame, and that runs at a rather high temperature, anywhere from 120 to 160.

Mr. Lawrence—Do you find that is better than at a boil?

Mr. Chase—It seems to give the best results.

Mr. Lawrence—Do you think there is any difference

in the luster after mercerizing if you sour the goods afterward or just give them a thorough wash in water?

Mr. Chase—There shouldn't be any difference at all. When goods are properly mercerized, you have an entirely different and new chemical substance there, and unless they have very harsh treatment you should have just as good a luster after souring, or after chemicking as you do before.

Mr. Lawrence—Have you ever run into any trouble with streaks in mercerizing where you were using the spray pipe? That is, after mercerizing when you are using the spray pipe, the tendency is to form in streaks, due to insufficient washing; the spray pipes become clogged in some way so as to form streaks along the goods.

Mr. Chase—We take elaborate precautions to see that the spray pipes don't become clogged, by means of filtering and straining of the liquor before it goes to the spray pipes; in that way we keep those holes open at all times; there is a constant flow of caustic and we don't get any streaks.

Mr. Deady—I might add a remark on the use of spray pipes. We have a pipe that is somewhat in the shape of a dust pan and we have it flow over that like water over a dam; and that, we find, gives us better results than spray pipes.

Mr. Chase—We have that on some of our machines.

Dr. O. R. Flynn—I would like to say something about this question of resist.

The trouble ordinarily encountered in dyeing mercerized goods wouldn't properly come under the head of resist. My experience would tend to show that it is largely a question of oxycellulose and that it is not due to the kier boil at all, but is due to the drying out of the goods, as the principal speaker remarked, which, of course, doesn't result in the formation of resist, but results in the concentration of the caustic soda in the goods at simultaneous oxidation. These effects in dyeing will usually be found not to show a lack of concentration. If you drop ink on these spots they usually absorb, but they fail to dye properly with direct colors; and if you take this same piece of goods and dye it afterward in basic colors, instead of a resist effect you will find a mordant effect.

While the principal speaker was delivering his paper the question came to my mind as to just how he disposed of the goods during the process of mercerizing while he accumulated a kier, but he said subsequently that he ran the goods directly into the kier, which, of course, must leave the kier out of use quite a considerable time, as the process of mercerizing is comparatively slow. But if he has plenty of kiers, of course, there is probably no objection to handling it in that way.

Mr. Deady—In reference to those resists I mentioned, we found by souring the goods we got rid of the resist; after souring and washing they dyed up perfectly all right. So the oxycellulose wouldn't be affected that way.

President Olney—Are there any further questions or discussion?

Mr. Carter—We speak about washing on the frame by spraying with hot water. I made a number of investigations as to the efficiency of this in the past, and it may be of interest to you to know that I found that washing with hot spray removes from 60 to 70 per cent of the total caustic carried by the piece, according to the style of cloth which is being mercerized. This loss occurs before it leaves the clips of the stenter to enter the open washing sections.

There is another matter which may be of interest in regard to the history of mercerizing. Many years before mercerizing under tension was practised, there was a process for engraving rollers for printing, in which mercerizing was employed. This was for the production of lace designs. A piece of curtaining lace of pretty open pattern, not too elaborate, was taken and put around a copper roller, so that the pattern, or as we would say in printing, the sketch of the design met. The edges were then skillfully sewn together. Strong caustic was then poured over the roller which, mercerizing the cotton, caused it to shrink very tightly on to the roller.

The roller after washing with hot water to remove the caustic was placed in a depositing vat in which it revolved with the anodes on each side.

When sufficient copper was deposited it was taken out, washed off, and the lace removed. As no deposit of copper could form where the lace was tightly shrunk on to the roller, the pattern of the lace was produced and utilized for printing.

The lace being generally made of Egyptian cotton, the swatches taken off the roller showed a high luster. I often noticed how lustrous these were, but the matter stayed at that. As I have never seen any mention of this in literature on mercerizing, I think it is an interesting matter to state.

After the goods have passed through the caustic pad, there are two ways in which they may be treated. They may be stretched out to width, or in other processes the cloth is not allowed to shrink. There have been different machines brought out which prevent shrinkage during the caustic treatment. One of these machines was that of David, of Paris. In this the cloth engaged in the stenter chain, which then ran through a pan of caustic, the excess of which was stroked off by rubber doctors underneath which were suction boxes. It then went forward for hot spraying and so on. In this way shrinkage was prevented.

Other machines, notably the Boral & Kymer Machine, did away with the stenter altogether.

The cloth passes into the caustic box and around rollers

in frictional contact, then through the three bowls of the caustic pad and over a series of bowls in frictional contact, a top row and a bottom row; the bottom row being positively driven, the upper row which is of much larger diameter, being driven by frictional contact with the lower row.

The shrinking action of the caustic makes the cloth hug the bowls tightly, so that the more it tries to shrink the more it prevents its own shrinkage.

After having traveled a certain length over this series of bowls to give the caustic time to act, the cloth passes to another series of bowls on which it is washed with hot sprays after which it passes to the usual open washing and scouring.

This machine treats light and fragile cloths successfully and generally gives very excellent results.

I think these facts will be of interest to the meeting, as I went into mercerizing just about the time it came into vogue and studied the question in England, France and Germany, in order to start properly over here.

Thank you. (Applause.)

Mr. Deady—Mr. Carter, in that apparatus that you mentioned where the tenter frame dips down into the caustic and the excess is scraped off by the doctor, hasn't your selvedge a tendency to be heavy? You wouldn't get at the selvedge there, would you?

Mr. Carter—I saw the machine in operation, and, of course, it held in the tenter just the same as in the ordinary machine, but these rubber doctors went on each side and stroked the caustic off; there were suction boxes underneath, and as they passed further on there were still more suction boxes.

President Olney—I think, perhaps, we had better pass on to the next paper, "Indigosol O and Other Indigosol Colors," by Mr. C. W. Kuhl, President of the Carbic Color and Chemical Company. Mr. Kuhl. (Applause.)

Mr. Kuhl—Mr. Chairman, Ladies and Gentlemen—I wish to thank the Association for giving us this opportunity of saying something about Indigosol. I am going to take the liberty of reading to you an address given by Mr. Charles Schreiner, Commercial Director, and Dr. Peterhouser, Technical Chemist of Durand & Huguenin, S. A., before the National Superior School of Arts and Textile Industries at Rubaix. It will give you the foreign viewpoint and there is so much more of that stuff used over there than is used here that I think their viewpoint will be of interest. There may be some things in this paper that you won't agree with. I don't agree with some myself, but at the same time it won't do any harm for you to hear it.

. . . Mr. Kuhl then presented this prepared paper, which is published herewith. . . .

INDIGOSOL O AND OTHER INDIGOSOL COLORS

[*An address given on October 26, 1924, by Charles Schreiner, Commercial Director, and F. Peterhouser, Technical Chemist, of Durand & Huguenin, S. A., at the National Superior School of Arts & Textile Industries at Rubaix.*]

Indigosol O Pat. is a sulphonic acid ester salt of Indigo, soluble in water and stable. While it retains all the characteristics of Indigo, Indigosol O offers very great advantages and permits of new and easy applications which it was impossible to obtain up to now with the methods of applying Indigo.

It is the first representative of a new and highly interesting class of dyestuffs which have a great future; in fact, besides Indigo and its derivatives there are bodies of all the series of vat colors which permit of being esterified, just like Indigosol O, so that within a more or less short period it will be possible to put at the disposal of the textile industry a whole series of esterified vat colors which will allow of obtaining a complete range of shade.

So far only Indigosol O is on the market, and has been manufactured in large quantities, but in the near future will follow Indigosol O4B, the esterified product of Tetrabrom Indigo; i. e., of Ciba Blue 2B or Indigo MLB/4B.

The other Indigosols will follow as soon as possible, according to the possibilities of manufacture.

What differentiates Indigosol O from Indigo is that in order to apply the latter it is necessary to dye in an alkaline vat and oxidize in the air, while in the case of Indigosol O the vat falls away entirely, both on wool and on cotton. Indigosol O has no affinity for vegetable fibers; on these the application is by impregnation.

The dyeing of cotton, notably of piece goods, is carried out in three different ways.

The first one consists of padding the fabric in a simple solution of Indigosol O, passing through the squeeze rolls, drying in the hot flue or on drying cylinders, and afterwards oxidizing in a bath containing perchloride of iron and sulphuric acid, then washing.

The second method differs from the first in that nitrite of soda is added to the dyestuff solution; the goods are padded, dried as above, then passed through a dilute sulphuric acid solution, in which the oxidation takes place rapidly. When using this nitrite method a small amount of beta naphtholate of sodium is added as a preservative.

With the third method the cloth is padded in a solution of Indigosol O to which small quantities of neutral oxalate of ammonia or sulphocyanide of ammonia, chlorate of soda and ammonium vanadate have pre-

viously been added, then dried and steamed for two to five minutes. By increasing the quantity of vanadate the oxidization even takes place by simply hanging up the goods in a damp and warm atmosphere.

The dyeing of cotton yarn skeins and bobbins has not so far been satisfactorily possible, as the drying after impregnation is a serious obstacle. However, recent tests on a small scale have shown that by adding per liter of padding color about 200 grams of a 10 per cent solution of glue and 30 grams of a 4 per cent solution of formaldehyde 40 per cent, the intermediate drying can be dispensed with if, in the case of cotton yarn, care is taken to thoroughly hydroextract, and, as far as piece goods are concerned, to squeeze well. The quantity of formaldehyde can be reduced to 20 grams by a further addition of 20 c.c. of a 20 per cent solution of bichromate of soda.

By treating the pieces dyed with Indigosol O according to the perchloride of iron or nitrite process with pyrolignite of iron and sumac, shades are obtained which are admittedly duller but immensely deeper. By topping the treated pieces with Methyl Violet or other basic colors the shades obtained are much faster to washing than the vat Indigo shades topped with logwood and basic colors. This treatment bids particular interest for the obtaining of those copper shades which are so much in demand in the north of France and the west of Belgium.

For calico printing there is no doubt that Indigosol O offers the newest and most varied applications, either for direct printing or for the white or colored reserves. The direct printing of Indigo could only be done according to the glucose process, which is complicated and irregular, while with Indigosol O direct printing is possible in the simplest and easiest manner by the following methods:

1. By printing on a color containing, besides Indigosol, the necessary quantity of nitrite of soda, drying, and simply passing through a dilute acid bath, without steaming.

2. By adding to the printing color instead of nitrite of soda a more energetic oxidizing agent, such as sulphocyanide of ammonia, and, after drying, steaming three to five minutes, when the blue develops without passing through acid.

White effects can be obtained:

1. By discharging the oxidized blue as above.

2. By padding with the Indigosol nitrite solution, drying and printing on, before the oxidation, a hydro sulphite reserve, then passing through the acid bath. In this resides a new process only possible with Indigosol O and permitting the obtaining of whites without steaming.

3. According to the further new process which consists of padding the cloth in a bath containing as oxidizing agent ammonium sulphocyanide, chlorate of soda and ammonium vanadate, drying, and printing on a white reserve of thiosulphate of soda, then steaming for three to five minutes. Colored effects can be obtained with processes 2 and 3 by printing on before the oxidation a colored reserve prepared with either lake, basic or vat colors, and steaming afterwards.

By working with process No. 3 one does with Indigosol quite the parallel of the Prud'homme style with Aniline Black.

One can even obtain colored reserves without steaming by printing besides a white reserve the rapid colors (stable diazo compounds of para nitraniline, para nitro orthoanisidine, meta anitraniline, etc.). The red-blue style so much in vogue in certain countries can thus be produced without steaming.

The use of Indigosol O is indicated for block and yarn printing according to the nitrite or steaming process. The nitrite process is so simple that it can serve for a variety of artistic and home applications, as it is sufficient to apply with a spray or brush, drying and oxidizing in dilute acid.

Even photographs can be made on cloth by the following method: Pad in a solution containing per liter 60 grams Indigosol O, 5 grams thiosulphate of soda and 200 grams ammonium chlorate 15 deg. Be. Squeeze and dry at a low temperature(this is essential) and as much as possible in the dark. Expose to daylight just as for P. O. P., and when sufficiently developed soap in a large quantity of hot water in order to eliminate the dyestuff adhering to the undeveloped parts.

One of the most sensational applications of Indigosol is its use for wool dyeing. If, as we have previously stated, this dyestuff has no affinity for the vegetable fiber, it has, on the other hand, a great affinity for wool. Just as in the case of cotton, the vat dyeing is entirely done away with. One proceeds exactly as for any other after-treated dyestuff, by dyeing first in an acid bath and, after complete exhaustion, oxidizing. There are two practical methods of oxidizing: one with nitrite of soda, the other with bichromate of potash or soda.

By oxidizing with nitrite one can combine Indigosol O in the same dye bath with all those acid colors which stand nitrite.

As Indigosol O possesses, with the exception of fastness to rubbing, the maximum resistance to light, milling, alkalies, sea air and water, perspiration, etc., it is advisable to choose for the combinations only those acid colors which themselves possess good properties. Indigosol O levels and penetrates very well and possesses superior fastness properties to any of the other acid blue colors used so far.

The oxidation with chrome is done at 20 deg. Cent. for straight Indigosol dyeing or in combination with those chrome colors that develop at a low temperature. It is thus that the commercial Indigo dyeings can be obtained with Indigosol O in combination with chromotrope FB, Sulphoncyanine, etc.

If, on account of a number of reasons, the use of Indigo on wool has been gradually reduced to the dyeing of loose wool and slubbing only, one of the principal reasons is certainly the difficulty of dyeing yarns or pieces in the vat.

However, in view of the remarkable fastness properties of Indigo on wool, fastness properties which, excepting the fastness to rubbing, have so far not been obtained with any other dyestuff, the dyeing with Indigo has remained a wish with the consuming clientele. There are countries in which Indigo has remained the basis of fast color dyeing. The study of this dyeing has been pushed in those countries to such a point of perfection that it has become a specialty or even a monopoly.

The facility with which Indigosol O can be used today allows any dyer to dye Indigo on wool, whether it is in the form of raw stock, slubbing, yarn or pieces, as well as mixed fabrics, and this without any other installation than what is used for other dyestuffs.

As to the advantages offered by Indigosol over Indigo Vat, our experiences and results obtained up to now enable us to mention the following:

1. Indigosol does not stain white or colored effect threads of cotton, mercerized cotton, artificial silk or silk, all of which are stained in the vat. It is therefore possible to produce with Indigosol O styles which were impossible with vat Indigo. This feature compensates to a great extent the still too high price of Indigosol O.

2. Over the dyeing of piece goods in the vat, Indigosol offers every advantage. Greater production, better penetration and more level and uniform results.

3. By eliminating the vat the labor cost is considerably reduced. Firms which do not run Indigo vats can produce in their ordinary kettles Indigo grounds, enabling them to do work that was impossible before. Also, the fuller's earth treatment necessary for Indigo vat grounds is superfluous with Indigosol O.

4. The possibility of combining in the same bath Indigosol O with acid or chrome colors, while in the case of vat Indigo the topping means a second process, represents a decided saving and permits a larger production.

5. With Indigosol O, wool can be dyed in practically any apparatus, even in those in which vat dyeing was impossible, such as the Klauder-Weldon. This feature, with the fact that Indigosol combines directly with acid and chrome colors, saves considerable handling and boiling, leaving the wool in better condition for spinning, with less waste and a better feel.

If this new product has many advantages it has also some drawbacks, but these are early-stage troubles inherited partly from its senior, Indigo, which will vanish in time. For instance, it has been observed in practice that cloth of very fine yarn is more difficult to dye solid than that made from coarser yarn. We have succeeded in overcoming this drawback by the observation that to obtain solid results the boiling must be sufficiently long. After the dye bath is exhausted it is advisable to add 2 per cent sulphuric acid and boil one-half hour longer.

The second drawback inherited from Indigo is crocking. It has happened that of ten sets dyed one after the other by the same workman, with the same ingredients, and Indigosol from the same package, some pieces were irreproachable, perfectly level and fast to rubbing, while other pieces crocked.

We have found that the rubbing off in the case of Indigosol is due entirely to fat or grease still adhering to the wool, and the best preventive is naturally perfect scouring. As, however, this seems to be impossible with the methods in use at present, we have found that the addition of small amounts of hydrosulphite formaldehyde to the dye bath, or a longer boil, after the color is exhausted, with the addition of sulphuric acid, helps to minimize this defect. The grease is not eliminated, but the Indigosol separates from the grease. After oxidation, the usual cleaning with fuller's earth, with or without a grease solvent, is also very effective. It is in these treatments or precautions carried out by experts that the successful dyeing of Indigosol lies.

If, as it can be hoped, an absolute fastness to rubbing can be obtained, Indigosol O will be the only dyestuff which will embody the maximum of all fastness properties which can be required from a fast dyeing.

The third and main drawback, which refers to all the fibers, is that the present price is still too high. If, even at the present price, many uses are already possible, it must be admitted that for the classical styles the price is still too high. But also in this case at least a partial remedy is in sight in the more or less near future.

The day when Indigosol O will be manufactured on a very large scale, a further and marked reduction in price will be made which will allow its use ont only in nearly all the cases where Indigo is used but even in many cases where it is to-day impossible to use Indigo. In the meantime it lies in the interest of every colorists to make practical tests so as to be ready for the day when the reduction in price can be made.

President Olney—This has certainly been a very interesting contribution on the subject of Indigisol colors. Are there any questions you would like to ask? I am sure there is an opportunity for some, although that paper has covered the subject very fully. Are there any questions? (There were no questions asked.)

I do not know how nearly ready the tellers are to report. They say it will take from fifteen to twenty minutes longer to finish their work.

The latter part of our program consists of three subjects which are announced for discussion if time permits. We must wait fifteen minutes anyway for the tellers and so there is an opportunity to discuss these subjects. We can do no better than take them up in the order in which they appear on the program, and we shall have to depend upon those present who are thoroughly conversant with these subjects to start the discussion.

The first subject is "The Dyeing of Three Fiber Hosiery." I might say that all of these subjects were called for upon the questionnaire as subjects that various members would like to have discussed at the meeting. Who is willing to open the discussion on that first subject?

J. S. Unterweiser—Professor Olney, I will open the discussion on that subject with a little paper that I have prepared.

. . . Mr. Unterweiser presented his prepared paper, which follows herewith. . . .

THE DYEING OF THREE FIBER HOSIERY

By Joseph S. Unterweiser

In recent years the problem of the hosiery dyer has become a real source of worry, as he has to contend with dyeing so many different combinations of materials, and the shades he has to make are so numerous that it requires all the skill at the command of the dyer to keep up with the changes that are constantly taking place, in both materials and shades.

One of the many troubles that confront the dyer of to-day when he has light shades to produce on cotton and silk hosiery is to get the color to dye level and at the same time to get the color to penetrate into the seams. It has been the custom heretofore to degum the material and then dye, but this methd in most cases has proven to be unsatisfactory and therefore a new process had to be looked for. After numerous experiments it was found that by leaving the gum in the material and then degumming and dyeing in one operation, that very good results were obtained and the hosiery cominng out of the dye bath when dyed this way is level in shade and the seams are well penetrated. The usual procedure for using this method is to wet out the material in boiling water for about fifteen minutes. The temperature is then lowered to about 100 deg. Fahr., and the necessary amount of either boil-off oil or soap, whichever the dyer prefers to use, and the dyestuff is added to the dye bath. The goods are then worked for a short while at this temperature and the steam is turned on and the bath brought to a boil. After the material has boiled for about thirty minutes and a sample is taken, the silk is considerably heavier than the cotton, which is due to part of the gum still being left. This, however, will not be the case after the gum is entirely removed, which usually takes about one hour. You will then find that the silk will have to be shaded with some neutral dyeing acid colors if only direct colors were used at the start. A small quantity of salt can be added to the dye bath if desired, but this is left to the discretion of the dyer, as there are quite a number of dyers who prefer to eliminate the salt entirely when dyeing light shades. This method of dyeing you can readily see would save considerable time, as the degumming process is eliminated and by reducing the time that the goods are in the dye bath the material is left in a much better condition and the possibility of chafe marks on the silk reduced to a minimum.

The dyeing of triple fiber hosiery consisting of tram silk, artificial silk and cotton is another problem the hosiery dyer has to contend with, as here he has the addition of the artificial silk fiber, which we all know has a greater affnity for direct colors than the cotton, but this condition can be corrected by eliminating the salt from the dye bath at the start, in which case the cotton will take up most of the color, especially so when dyeing light shades. The dyeing is usually started at a temperature of 100 deg. Fahr. with the addition of 1 per cent of soluble oil and color, brought to a boil and run for about twenty-five minutes. A sample is then taken and you will notice that the artificial silk will be lighter in shade than the cotton. An addition of common salt at this time will force the color to go onto the artificial silk and a good union between the cotton and artificial silk is obtained. Care must be taken not to add too much salt, for then the artificial silk will pick up too much of the color. This, however, can be controlled after a few experiments. The shading of the tram silk you all know can be done with neutral dyeing acid colors.

For the production of heather effects which have been quite popular lately, such materials as wool and cotton, silk, artificial silk and cotton, wool and silk are largely used. The wool and cotton hose are usually made with the heel and toe of cotton and the body with a combination of wool and cotton. This class of material is mostly dyed with the one-bath process with neutral dyeing acid colors in conjunction with direct colors that do not stain the wool to any great extent. When better fastness is required, the cotton can be dyed with sulphur colors in a soap bath at a low temperature having bicarbonate of soda present to protect the wool from the sodium sulphide and soda ash. The wool will be left fairly clean and

can be easily cross dyed with chrome colors. The cotton, artificial silk and tram silk combination is made with cotton used for the tops, heel and toe and the silk and artificial for the body. This can be dyed with direct colors which have only a slight affinity for the silk in combination with neutral dyeing acid colors. The cotton and artificial silk will then be the same shade, while the silk can be dyed any shade desired. Where wool and silk is used in combination, the heel and toe is usually made of wool, while the rest of the stocking is composed of both fibers. For dyeing, chrome colors leaving silk clean can be used for the wool, and the silk then shaded with direct colors. Usually the shade desired on the silk is considerably lighter than that on the wool and therefore the color which is used in shading the silk will not affect the color on the wool to any great extent.

Discussion

President Olney—Are there any questions you would like to ask or remarks you would care to make in regard to this subject? With the introduction of artificial silk, of course dyeing of three fiber material has become of great importance and interest.

The next subject is "Recent Progress in the American Dye Industry." That is a subject that opens up considerable territory for discussion, all of which should be very interesting. Is there anyone here who is willing to say something about the more recent developments in the progress of the American dye industry? Dyestuff manufacturers who are present mustn't be too modest in regard to their accomplishments.

Well, we will pass along and come back to that later if there is time.

The next subject that was suggested was "Speed Limit of Successful Dyeing of Piece Goods." I think that heading has a number of interpretations, and I am of the opinion that Mr. Robbins might have something to say about at least one. Mr. Robbins! (Applause.)

Mr. Robbins—It is a good thing I got the cheering first (laughter); I may be praying for it afterwards. I have very serious doubt as to whether I can offer any suggestion that will be of value to the meeting as to the successful dyeing of piece goods. There is no indication from the title of the subject as to what kind of piece goods is meant, cotton or wool.

Some observations have come before me as to the difference in the shades, or fastness of the shades produced by a momentary contact with the dye and a time exposure. It is along that line that I would be more likely to have an interest in the topic under discussion, and that would be from the manufacturer's more than from the consumer's standpoint.

Goods that have been made from stock dye material, cotton, of about the same shade as dyed in the piece by momentary exposure, have been found to be faster, both to washing and to light, than the time exposures of the stock dyed.

As to how rapidly the continuous process may be done, that would seem to involve the matter of how fast the goods can be handled. The difference between running thirty yards per minute and one hundred or one hundred and twenty should not make a perceptible difference in the fastness of the dye; and the faster it can go, the probability is, the more even the shade will be.

If that is applied to woolen goods, on the contrary, it is a different proposition. I would be glad to hear someone who is a little bit more familiar with the work than I discuss the question of whether or not there may be some process developed whereby the proper shades can be obtained on woolen piece goods without having to run them so long in the kettle. It seems that for some processes the length of time it is in the kettle in order to obtain the proper shade is unreasonably long. It is injurious to the face of the goods and often produces a fulling effect aside from that, and if some process could be devised whereby a perceptible time could be taken off from the running of the pieces in the kettle it would be a very desirable thing to do.

That is, I think, all that it is worth while for me to try to say to you, and it is only with the object of opening the question which somebody may settle with some benefit to the people attending the meeting. (Applause.)

President Olney—I think there may be some questions in regard to what Mr. Robbins has said. The last point he mentioned is a very good one, I think. It sometimes happens that textile material is half worn out before it leaves the plant. That is quite true when some mistake has been made and material has to be redyed several times perhaps, and if it is true under those conditions it is true to a lesser degree in the ordinary process of dyeing. If these processes which extend through several hours could be improved upon so that you could get as fast and as even results in a shorter time this wear of the cloth might be minimized; but that is proposing quite a problem.

Is there anyone here who has any further remarks to make in regard to the subject? (There were no further questions.)

I will ask Mr. Lewis to make a report for the tellers, and I want to say that they have had far more of a job than I anticipated. We thank them very much for their labors.

Mr. Lewis—There was a total of 306 ballots and the results are as follows: Professor Louis A. Olney is elected for President, William D. Livermore and Dr.

Elvin H. Killheffer for Vice-President, Walter E. Hadley for Secretary, Winthrop C. Durfee for Treasurer and Ralph H. Culver and Arthur H. Hirst for the Council for three years. (Applause.)

President Olney—You have all heard this report and as President the only alternative I have in the matter is to declare these men elected to their respective offices. I simply hesitate on account of declaring the first one on the list.

I wish to thank you for the honor that you have again bestowed upon me this morning, and I certainly shall endeavor to do everything that I possibly can to promote the interests of the Association during the coming year.

I thank you. (Applause.)

In this connection I wish to say, however, that Mr. Cady was one of the men that had more than the proper number of votes on the nominations to appear upon the ballot, but he very insistently urged us to drop his name and finally, in compliance with his request, we did so.

It is time to adjourn and we will do so without any ceremony. The afternoon meeting will begin at 2 o'clock at the Philadelphia Textile School, which is two blocks down the street.

. . . The meeting adjourned at 1 o'clock.

APPLICANTS FOR MEMBERSHIP

Active

Fischer, Henry Frederick, colorist, Technical Laboratory, Du Pont, Wilmington, Del. Sponsors: George H. Schuler and R. E. Rose.

Gamble, Edward H., textile chemist, Technical Laboratory, Du Pont, Wilmington, Del. Sponsors: George H. Schuler and R. E. Rose.

Haworth, Richard, president and treasurer, Richard Haworth, Inc., Providence, R. I. Sponsors: Wm. Witte and Tom Turner.

Hoffner, Joseph P., president, Hoffner Silk Dyeing Company, Philadelphia, Pa. Sponsors: J. H. Hennessey and B. K. Archer.

Jardine, Wm., colorist, Manhattan Print Works, Passaic, N. J. Sponsors: Dr. Stewart F. Carter and Dr. Alfred Pfister.

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Nash, W. F., textile chemist, Technical Laboratory, Du Pont, Wilmington, Del. Sponsors: George H. Schuler and R. E. Rose.

Junior

Johann, Albert Frank, textile colorist, Newport Chemical Works, Passaic, N. J. Sponsors: E. A. Keeler and Joseph S. Unterweiser.

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Firsching, Henry, 124 McKinley Avenue, Glendale, L. I.

Hacking, Arthur, Norwood, R. I.

Tice, M. E., 47 Zeigler Tract, Penns Grove, Pa.

Watt, Howard R., George W. Watt Woolen Company, Norristown, Pa.

CHANGES OF ADDRESS

Adams, Carleton C., 56 Broadway, Haverstraw, N. Y.

Anderson, Arthur I., 1 Highland Avenue, Wakefield, Mass.

Claflin, Alan A., L. B. Fortner Company, 85 High Street, Boston, Mass.

Davagne, P., 31 Beechwood Avenue, Pawtucket, R. I.

Fletcher, Allison R., 49 Princeton Avenue, Providence, R. I.

Goldman, Moses H., 27 Glenville Avenue, Allstron, Mass.

Jones, A. S., 17½ Jackson Street, North Adams, Mass.

Matthewson, E. P., 868 Hope Street, Bristol, R. I.

Millson, Henry E., 8128 Hennig Street, Philadelphia, Pa.

Payne, Lorne, 82 North Main Street, Windsor Locks, Conn.

Stringfellow, W. A., 6016 North Twentieth Street, Philadelphia, Pa.

Tew, Arnold George, Ciba Company, 26 Custom House Street, Providence, R. I.

AMERICAN
DYESTUFF REPORTER
SAMPLE SWATCH QUARTERLY

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

CLAYTON HOAGLAND
Managing Editor

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A CHEMICAL ADVISORY COMMITTEE

THE first step in an important movement is not always ushered in with a brass band. It is more commonly the experience that the first announcement of a notable project will appear as an obscure "filler" at the bottom of a news column. Evidently no authoritative information is available to confirm the report that the Chemical Division of the Department of Commerce is organizing an advisory committee of prominent chemical and dyestuff men to work with the division, else the news would have elicited more audible comment from the trade. It is merely said that C. C. Concannon, chief of the Chemical Division, is not prepared to comment on the details of the plan.

If the Chemical Division is actually taking steps to form a committee of manufacturers' representatives to co-operate in the work of the division, it is important news. Socialists advocate industrial representation in government to replace the oft-decried system of geographic representation. Although a chemical advisory committee could not strictly be termed representation in government, yet the fact that dyestuff and chemical manufacturers would co-operate in the work of a Government department would mean for our dye industry a greater degree of recognition in legislative matters affecting the industry.

The Chemical Division doubtless foresees many significant advantages in the formation of an advisory committee of chemical manufacturers. The committee would be of inestimable help to the division in its not infrequent investigations and surveys of domestic and foreign dye and chemical markets. As the work of the Department of Commerce is closely related to that of the Tariff Commission, the chemical advisory committee would be of equally important assistance in attaining more efficient tariff administration.

Where a chemical advisory committee would prove of the greatest practical assistance to the Government is in the compilation of reports and the dissemination of literature pertaining to dyestuff and chemical production, prices, imports and exports—the annual census of dyes, for instance. Every dyestuff manufacturer recognizes the value of accurate Government statistical reports and every manufacturer will likewise comprehend how such reports can be made of greater accuracy and value if in their preparation the Government is assisted by capable and willing representation from the industry.

Should the Government fail to develop this plan it would be well if dyestuff manufacturers were to approach it on the subject and offer their hearty support in the project. If their offers produce no results they might, with advantage, even be so audacious as to specifically request representation in the work of the Chemical Division. For after all it is not the Government that will profit most materially through any co-operative action with the dyestuff industry. Although the committee would promote greater efficiency in the work of the Chemical Division, yet it is the dye manufacturers who in the end will profit. It is the dye manufacturers, therefore, who should be most concerned in carrying out the idea. Passive approval is not sufficient; what is needed is an active desire to work out the plan to its fullest possibilities.

DYE SALES NOT A BUSINESS BAROMETER

A READER of The REPORTER who has given thought to an editorial appearing in our issue of October 6, entitled "Dyes As a Business Barometer," takes exception to the arguments therein set forth. Upon mature deliberation we are inclined to agree with him and conclude that our previous view of the subject was erroneous. His comment follows:

> Some time ago it was suggested in your editorial columns that the statistics of dye sales would form a good business barometer, equal in importance to the records of check transactions, new buildings and similar data. This could never be.
>
> Although the dye industry has been classified as a "key industry," it receives this characterization from the chemical importance of the products manufactured. These products are vital in the production of colored textiles, paper and leather, and in numerous phases of chemical manufacture, but in volume of production, either in pounds or in dollars, the products of the dye industry are extremely small in comparison with the major industries. The dye industry is by far too small a portion of the business of the country to ever effect or to indicate the trend of general business.
>
> Nor does the record of dye sales indicate the trend of the industries to which they are most closely allied —the textile, paper and leather trades. It is true that dyestuffs are used in these trades in the production of the finished products, but a comparison of dye sales with the consumption of cotton, wool, or silk, or with the production of paper or leather will show

that dye sales in general move in parallel with the trend of production in these industries, but with a definite *lag of one to three months behind the movement of the industries.*

Dye sales portray what has gone before, but this does not constitute a business barometer. A good business barometer of the trend of these industries is that given by the Harvard Economic Service. This index of industrial activity combines with the consumption of basic raw materials, such as cotton, wool, silk, etc., the hourly machine activity of the industry.

To be of the greatest value a barometer of conditions of business in general or of an individual industry should be the figures of the consumption of the most important raw materials. In no case are dyes the most important raw materials from the standpoint of volume; and volume of business alone influences the trend.

KNIT GOODS WEEKLY PURCHASED BY PUBLISHERS OF THE "REPORTER"

THE Howes Publishing Company, publishers of the AMERICAN DYESTUFF REPORTER, have purchased from the Textile Reporting Corporation a textile news publication known as the Knit Goods Weekly Trade Record. The first issue of this publication under the new ownership appeared Saturday, January 3. The former editor and the former advertising manager of the Knit Goods Weekly Trade Record will continue in charge of their respective departments.

The Knits Goods Weekly Trade Record is a digest of trade news and market reports covering the entire knit goods industry. It is very probable that this publication is well known to many readers of The REPORTER. In their endeavors to improve the services of this weekly during the coming year the publishers solicit the constructive co-operation of all of its readers, for they realize that its true value to the trade can be determined only upon the basis of its genuine service to every branch of the knit goods industry. With this in mind the publishers earnestly hope that those readers of The REPORTER who are acquainted with the Knit Goods Weekly Trade Record will contribute their hearty support to its improvement by continued interest in "the knit goods industry's only weekly."

The schedule of liabilities and assets of the Fiskdale Finishing Company, Fiskdale, Mass., adjudicated bankrupt on November 26, filed in the United States District Court, Boston, discloses debts of $153,255 and assets of $150,135. The only secured claim is that held by the Worcester (Mass.) Bank & Trust Company, for $41,499. Among the large creditors are Walter E. Schuster, treasurer of the Schuster Woolen Company and the Hayward Woolen Company, both of East Douglas, Mass., $15,000, on a note; Southbridge (Mass.) Printing Company, $10,000, note; E. L. Mirick, New York, $7,000, note; town taxes, $10,634.

THE NEXT KNITTING ARTS EXHIBITION

With the announcement of the twenty-first annual Knitting Arts Exhibition and Convention to be held April 6-10, 1925, at the Commercial Museum, Philadelphia, under the auspices of the National Association of Hosiery and Underwear Manufacturers, comes the surprising and encouraging news from Chester I. Campbell, manager of the show, that the number of reservations for space made to date is far in excess of any of the previous exhibitions.

The list of exhibitors who have applied for space reservations already numbers more than two hundred. This makes it clearly apparent that this year's show will far surpass any previous effort both in the number of exhibitors and in the quality and character of their exhibits. It shows, too, that the progressive manufacturers, jobbers and retailers are awaking to the unrealized commercial possibilities attendant to this annual exhibition.

At the close of last year's show the promoters received a flood of congratulatory letters from practically every exhibitor on the floor. The messages conveyed ranged all the way from congratulations on the efficient manner in which the show had been conducted to expressions of gratitude for the amount of business that had been done. The unanimous sentiment of everyone, however, was that the entire event was the best ever. At that time it did not seem that any succeeding exhibition could equal the last one let alone surpass it. This year, however, with the date almost three months away there is every indication that the forthcoming exhibition will set a new high record for advancement and progress in the Knitting Arts Trade.

The purpose of the exhibition is apparent. It is the only possible link between the three branches of the trade, viz., the manufacturer, the jobber and the retailer. It forms the common plane upon which they all can meet to discuss ways and means of improving conditions for each other. A boost for one is a boost for the other, and any means of personal contact that accomplishes this end is bound to be beneficial. To carry the deduction a bit further it follows that business conditions as a whole are benefited by anything that benefits any part of business.

This year's exhibition will be like the one held last year in all of its principal events. The events themselves will be on a broader scale than ever before because the increased attendance that is expected will necessitate it. There will be more and larger displays of machinery and equipment, with special attention being paid to inventive improvements during the past year.

There are still available a limited number of excellent spaces for exhibitors. Full information concerning these may be secured from Chester I. Campbell, 329 Park Square Building, Boston, Mass.

The Charlotte, N. C., branch office of the Sandoz Chemical Works, Inc., is now located at 435 South Church Street, Charlotte. John Hartley and T. B. Meisenheimer are still in charge of this branch, with offices at this address.

Technical Notes from Foreign Sources

New Finish for Cotton Threads

If cotton is treated with highly concentrated nitric acid in the presence of products formed by the action of nitric acid on cellulose, starch, protein, a shrinking of the fabric takes place, but at the same time a crimping and roughening of the threads occur. The fabric that is treated in this manner resembles in appearance and feel more of a woolen fabric than a cotton one. The new process which was discovered in Germany gives a new form of finish to the cotton threads. It is said that this process, which is known as philanizing, yields threads of cotton which show a greater affinity for dyes as is the case with mercerized cotton fiber. It is also claimed that apart from the more beautiful appearance of the fabric and the softer feel of the same, the latter is also more durable than ordinary cotton fabric.

The technical carrying out of the process offers many difficulties, for it involves the use of a strong acid, nitric acid, which is used in a highly concentrated stage. It is said that this process has been operated with success by the Hoechst dye works in Germany, in whose plants there is available large quantities of strong nitric acid. After the cotton threads have been philanized they are finished in the textile finishing works, the dye works and the print works. Colored fabrics which have been dyed with Indanthrene and other vat dyes as well as yarn, loose cotton, or roving, can be philanized. Articles made from these treated cotton fibers perhaps occupy a position midway between wool and cotton from the standpoint of cost

---

Overflow Apparatus for Bleaching with Oxygen

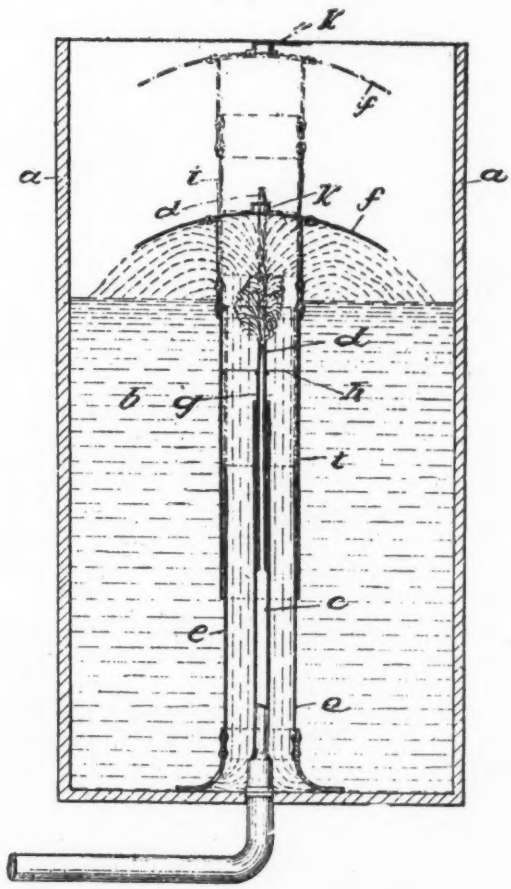
The purpose of the apparatus which is shown in the accompanying illustration and which is patented in German Patent No. 389,812 is to provide a means for obtaining a complete and uniform mixture of the steam with the bleach liquor and in this way also distributes the bleach liquor evenly over the fabric that is being bleached. This is attained by providing a telescopic distributing umbrella over the nozzle through which the steam is allowed to enter the bleach liquor. This makes it possible to arrange the outlet through which the steam enters the liquor at any point, independent of the quantity of liquor in the apparatus.

The bleaching tank is seen at *a* and *b* is the bleach liquor contained in this tank. Steam is allowed to enter the liquor through the pipe *c* which is connected with the tube *g* and the nozzle *d* which tube is made in a telescopic manner so that it may be increased or decreased in length. The tube *c* is surrounded by a larger pipe *e* made in such a fashion that the liquor in the tank is permitted to enter at the bottom, rise and flow out through the top. At the top of the tube *e* there is arranged another tube *i* in similar telescopic manner so that the height of this part of the apparatus may be increased at will. At the top of the latter tube there is connected an umbrella-like affair which distributes the liquor thrown up against it. This is seen at *h*. The spraying action secured in this manner serves to distribute the liquor evenly over the surface of the goods that are being bleached.

New Khaki-Coloring Process

In the production of the khaki color by means of the oxide of iron and that of chromium, certain difficulties arise due to the fixation of the chromium oxide which is used to tone down the color of the iron oxide. The process, which is described in the following, is based on the fact that by the use of a small amount of Ciba or algol dyestuffs chromium oxide can be dispensed with in the dyeing and a color obtained on the goods that is resistant to chlorine, to light and to soap. In other words, the product is as good in every respect as the ordinary iron khaki color.

The process or dyeing goods a khaki color is as follows: The first step is to slop pad the goods in the hot flue



in a solution whose composition is given below. In the apparatus employed for this purpose two rolls in the liquor and three squeeze rolls are employed. The composition of the liquor is as follows: Three grams of Ciba Violet in the powder form or, still better, 30 grams of a 10 per cent paste, 30 grams of glycerine, 15 grams of powdered sodium hydrosulphite, 3 grams of a 40 deg. Be. solution of sodium hydroxide in 30 c.c. of water and 100 c.c. of cold water.

The coloring matter is first mixed with glycerine to give a paste and then the hydrosulphite of sodium is added with constant stirring. Finally the cold water is added to the mixture while the latter is being constantly stirred with a wooden paddle. The preparation of the color mixture is much easier to carry out when the dye paste is employed instead of the dry coloring matter. After reduction has taken place, 30 grams of Rongalite C, dissolved in 100 grams of water are added. Then there is added a solution of 350 grams of iron pyrolignite of 14 deg. Be. strength dissolved in 250 c.c. of water and the mixture, which is made up to a liter volume, is carefully filtered through a screen to remove all lumps.

The second step in the process consists in subjecting the cloth to steaming for a period of five or six minutes in a Mather-Platt apparatus.

The third step consists in treating the goods with a solution of potassium bichromate, to the extent of 5 grams of the salt dissolved in 1 liter of water. The solution is used at a temperature of 80 deg. Cent.

The final stages of the process consist in washing, soaping, washing again and squeezing out the excess water between calender rolls and finally drying on drying cylinders. In the case of thick cloth it is recommended that all the treatments be carried out on the cloth in a flat position. By selecting the proper vat dyes to be used in this process it is possible to obtain any variety of a khaki shade.—Der Textilchemiker und Colorist, Number 14, 108.

Artificial Silk from Redwood Waste Bark

An article in the Oesterr. Chemiker Zeitung (1924, pages 129-130) discusses the project of making an artificial silk from the waste bark which can then be converted into the silk product. It is said that the bark contains as much as 25 per cent of cellulose which is located in the baste fibers. These fibers are mixed with cork cells and lignified tissue. For the isolation of the cellulose from such a mixture a special process is employed. The finely divided bark is first extracted with hot water in a revolving drum. It is then digested with a 7 to 10 per cent solution of nitric acid at a temperature of 90 deg. Cent. The operation is carried out in an acid-proof vessel, the mass being continually stirred for a period of several hours.

The cork cells and lignin are dissolved and the highly colored pulp is separated from the acid liquor and washed. It is then boiled for about 10 minutes with a 1 to 2 per cent solution of sodium carbonate. The material is then washed and treated again with an 8 to 9 per cent solution of nitric acid at a temperature of 90 deg., while stirring takes place constantly. After this second digestion the pulp retains only a pale yellow color. It is cooled and washed and then bleached with a 1 to 2 per cent solution of bleaching powder at a temperature of 70 deg. Cent. for a period of four hours. The resulting product is a perfectly white cellulose which is ready for conversion into viscose in the usual manner.

Formation of Dyes on Animal Fibers

In the Dutch chemical paper, Chem. Weekblad, 1924, pages 450 to 455, there is published a very interesting article describing the formation of dyes on animal fibers by reaction of the material itself.

Wool, silk, hair and other animal fibers yield ammonia continuously on treatment with warm water. On the other hand, when these fibers are treated with a cold dilute solution of nitrous acid for a period of twenty hours, intense yellow colors are developed, which colors are discharged by the action of light, heat and alkalies. After the treated fibers have been washed, they acquire distinctive colors on treatment with phenols or amines, without loss of mechanical strength.

The colors are fast to light and to washing, and may be modified by the action of metallic salts or bichromates. The sensitiveness of the product of the reaction with nitrous acid to light admits the possibility of a process analogous to color printing, the coupling being accomplished after exposure under a pattern. A list of the colors obtained with silk and wool by the action of various intermediates is given in the original article.

Coupling is carried out in faintly acid or alkaline solutions. The colors obtained in this manner are not fast to acids or alkalies, except when they are given an after-treatment with bichromates. It is claimed that the reaction appears to be a true diazotization of the amino groups of the protein in matters that are contained in the fibers.

Retting on Flax, Hemp, Etc.

A process has been patented in French Patent No. 556,887 for the retting of flax, hemp and other textile materials. This process differs from those commonly employed for this purpose in that it employs pure cultures of certain bacilli under certain definite conditions of temperature, aeration, etc.

The bacilli used to effect the retting are such that do not require sterilization of the textile materials before they are used. In fact, it is not necessary to subject the textile materials to any preliminary treatment before they are subjected to the action of the bacilli. These bacilli are found in the natural state during the hot season in temperate zones on the surface of the textile materials. The bacilli are easily isolated by ordinary methods and then pure cultures can be grown in media such as infusions of textile plant materials. The growth of the

bacilli may be controlled in such a manner that none but the desirous types are obtained.

The bacilli obtained in this manner are then put into a leavening vat and there by the maintenance of suitable condition they multiply very rapidly and a decoction is obtained which is ready for use.

The textile materials themselves are arranged in a large vat, the thickness of the pile of fibers being from 4 to 5 meters. The tank is then filled with water which is maintained at a temperature between 20 to 35 deg. Cent. About 100 hectoliters of water are used for every hundred kilograms of textile that are to be treated. The contents of the leavening vat are then added and 12 hours after this has taken place the retting of the fibers begins. The operation lasts for 60 to 80 hours, 72 hours in the case of flax. After retting has been well under way, it is advisable to remove about half of the water from the vat and replace it with an equal quantity of fresh water. Then it is recommended that the contents of the vat be sterilized by means of carbon disulphide or Javel water, which has the effect of diminishing to some degree the subsequent duration of the retting process.

Many advantages are claimed for the process, such as, the fact that the bacteria are found right on the textile materials themselves, that it is simple, requiring just a single culture which is used in ordinary apparatus, that no preliminary treatment of the textile materials is required, that the technology of the process is easy to carry out, that good results are obtained, etc.

A DOUBLE ECONOMY

If you add five pounds of dyestuff to 400 pounds of water and boil it up until there is *perfect mixture,* then insert your stock and get it to the shade you want, you have done a good job of manufacturing. But how about the economy?

Possibly you can afford to junk the 350 pounds of water left in the tub, but *can* you afford, right along, to pour out 3 to 3½ pounds of the dyestuff, every time you run such a batch, especially if the dyestuff costs upward of $3 per pound? Yet any thorough-going dyestuff chemist will tell you that this very thing is done so often as to be unpleasant to remember. The excuse is "standard practice."

Now the amount of dyestuff left in the water, even after you have "exhausted" enough of it to give you your shade, is where the wastefulness is. There are several remedial measures to greatly reduce the degree of this waste—shade control, forced dyeing, redesign of dye tubs—but the point is that the accomplishment of such reduction of waste will be found to effect a twofold economy of costly process-materials and of labor and time in process. This is because the upshot of bringing such improved methods to bear on the process is to cut down both space occupied by the operation and time to effect a result equal to and frequently better than that obtained by the old-fashioned methods.—Cotton.

SCHEDULES SENT OUT FOR 1924 DYE CENSUS COMPILATION

The United States Tariff Commission mailed to domestic manufacturers on January 2, 1925, schedules for compiling its annual "Census of Dyes and Other Synthetic Organic Chemicals" for 1924, as for previous years. This will make the eighth annual report compiled by the Commission on the production of dyes and organic chemicals in the United States. The Commission requests the domestic manufacturers of dyes and synthetic organic chemicals to co-operate by promptly returning these schedules completely filled out, so that the report covering 1924 may be issued early in 1925.

PROF. NORRIS HEADS AMERICAN CHEMICAL SOCIETY

Election of Prof. James F. Norris of the Massachusetts Institute of Technology as president of the American Chemical Society for 1925 is announced. Prof. Norris is chairman of the Division of Chemistry and Chemical Technology of the National Research Council. He succeeds Dr. Leo Hendrik Baekeland of New York.

Prof. Norris was born in Baltimore, Md., January 20, 1871. He received his A. B. at Johns Hopkins University in 1892 and the Ph.D. from the same institution in 1895. From 1895 to 1896 he was assistant in organic chemistry at the Massachusetts Institute of Technology. In 1896 he became an instructor, and in 1900 assistant professor. From 1904 to 1915 he was professor of chemistry at Simmons College and the following year held a similar professorship at Vanderbilt University. In 1916 he became professor of general chemistry at M. I. T. and continued in that capacity until 1920, when he was made professor of organic chemistry, a chair which he now holds.

During the war period he was an associate on the Naval Consulting Board; in charge of chemical research in war gas offense in the United States Bureau of Mines; Lieutenant-Colonel, Chemical Warfare Service; in charge of Chemical Warfare Service for England and inspection of German chemical war gas factories.

He is an assistant editor of the Journal of the American Chemical Society, and was president of the New England Section of the society during 1904-1905. Dr. Norris is a frequent contributor to the literature of chem-

istry and is the author of texts on organic chemistry and experimental organic chemistry.

The national spring meeting of the American Chemical Society, it was announced, will be held in Baltimore in April.

TEXTILE RESEARCH IN NORTH CAROLINA COLLEGE

It is announced by President E. C. Brooks that James McDowell, of Boston, an expert researcher in textile manufacturing, has been employed to direct the research work in the Textile School of the North Carolina State College, and will begin his duties in North Carolina on January 15.

At the present time Mr. McDowell is the technical expert in textile manufacturing for the Sharp & Hamilton Mills of New England, and the Brighton Mills of New Jersey. He is also special lecturer in the textile schools of Lowell and New Bedford, and is considered one of the foremost textile experts in America.

The research work which he will direct is regarded by authorities in the school as a very important development in the textile division of the North Carolina State College. The research will be devoted mainly to cotton and will comprise in part intensive study of types of domestic cotton with special emphasis on their affinity for bleaching, dyeing and mercerizing, the testing of yarns and cloth to determine shrinkage, standard breakage, strength, etc., the testing of starches used in sizing and the testing of dyes and their properties.

The L. B. Fortner Company announce the removal of their offices to 85 High Street, Boston, Mass.

The Mathieson Alkali Company has announced to its stockholders a proposal to increase the common stock 23,543 shares in order to meet part of the $2,500,000 necessary to finance plant expansion during 1925 and 1926. Dividends on the common stock have been postponed until these expansion plans are completed.

The Noil Chemical & Color Works is circularizing the trade with an announcement of Noil Develop Black BH, described as noted for its discharging properties and its clear greenish cast. Silk, Celanese and wool are left white in its use and it is said to be suitable for solid unions and to develop to bright shades.

The Bayer Company, Inc., New York, have recently distributed to agricultural experiment stations through out the country a leaflet describing a new product known as "Bayer Dust" for seed disinfection and plant stimulation.

John Campbell & Co. announce that after January 1 their Boston office and laboratory will be located at 287 Atlantic Avenue, Boston.

The Synthetic Organic Chemical Manufacturers Association has issued a 30-page booklet containing the complete proceedings, addresses and extracts, of the Third Annual Meeting of the association at the Hotel Commodore, December 12, 1924.

TWO NEW CIBA COLORS

Diazo Fast Blue 6GW and Diazo Fast Erica 2BW are two new dyestuffs which Ciba Company, Inc., are advertising by a folder in this issue of the AMERICAN DYESTUFF REPORTER. These new products appear to be exceptionally brilliant in shade, especially for dyestuffs diazotized and developed with beta-naphthol.

The manufacturers state that the colors are fast both to light and to washing, and being readily and purely dischargeable with hydrosulphite they should be of considerable interest to both the dyer and the printer.

DYES AND CHEMICALS WANTED

We buy for spot cash surplus and odd lots of chemicals, oils, dyes, intermediates, solvents, gums, glues, waxes and any item of a chemical nature. Republic Chemical Company, 303 Pearl Street, New York City.

DYESTUFF SALESMAN

Dyestuff salesman wants position. Experienced and has full knowledge of both domestic and foreign colors. Possesses executive ability. Clean record; best references. Address replies to Box 280, American Dyestuff Reporter.

EXPERIENCED HELPER

Young man, graduate in chemistry of the German Polytechnic at Karlsruhe, and having had several months' experience in the application laboratories of Fried. Bayer & Co. at Leverkusen, seeks an opportunity to enter a dyehouse as second hand or helper where he may have an opportunity to familiarize himself with American methods. Address Box 277, American Dyestuff Reporter.

DYER WANTED

Wanted—Man familiar with piece goods dyeing on jigs, pads and stick dyeing. Only a man experienced on cotton, and silk and cotton mixtures will be considered. Give full details in confidence to Box 282, American Dyestuff Reporter.

LABORATORY ASSISTANT

WANTED—Laboratory assistant thoroughly experienced on Vat, Sulphur and Chrome colors. State full particulars. Confidential. Box 283, American Dyestuff Reporter.

"Get-To-Gether"
April 6, 7, 8, 9, 10, 1925

Twenty-first Annual

Knitting Arts Exhibition

The Commercial Museum, Philadelphia, Pa.

UNDER THE AUSPICES

NATIONAL ASSOCIATION OF HOSIERY AND UNDERWEAR MANUFACTURERS

More than two hundred manufacturers and dealers in Knitting Machinery, Knitted Underwear and Outerwear, Yarns, Mill Equipment and Supplies will again show their products at the 1925 Knitting Arts Exhibition.

The ever increasing number of exhibitors is sure proof that the trade goes to this market to buy and view the new devices and improvements that manufacturers and jobbers have to offer.

Old exhibitors will tell you this Exposition is the most practical, successful method of merchandising they know.

Held in connection with the annual meetings of the National Association of Hosiery and Underwear Manufacturers it affords a wonderful opportunity for buyers to attend these meetings and at the same time view your product.

If you seek to widen your market you will be represented by an exhibit at this creator of new business.

DON'T MISS THIS OPPORTUNITY

The cost of a space measuring 10 x 10 or 100 square feet is $150, and includes Sign, Floor Covering, Desk and three chairs and general decorations all ready for your exhibit.

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Lykopon—Anhydrous Sodium Hydrosulfite for reducing indigo and vat dyes, for stripping, etc.

Formopon—Sodium Formaldehyde Sulfoxylate for discharge printing.

Indopon W—Indigo Discharge Assistant.

Formopon Extra—Basic Zinc Formaldehyde Sulfoxylate for stripping dyes.

Protolin—Soluble normal Zinc Formaldehyde Sulfoxylate for stripping dyes.

Protolin AZ—A special soluble Sulfoxylate for stripping dyes.

Our laboratory makes a special study of these products and their application, and appreciates the opportunity of co-operating with users in solving any problems which the employment of these products presents. Suggestions for stripping dyes from all classes of goods are supplied on request.

We also manufacture in our own plants a wide range of Heavy Chemicals, including Acids, Sodium Sulfide, Glauber's Salt, Aluminum Sulfate, Aluminum Chloride, liquid and crystals, Tartar Emetic, etc.

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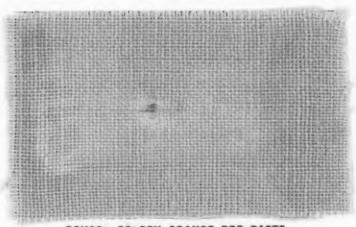

PONSOL GOLDEN ORANGE RRT PASTE
PONSOL YELLOW G DOUBLE PASTE
PADDED AS A PIGMENT

PONSOL GOLDEN ORANGE RRT PASTE
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PONSOL BLUE BCS PASTE
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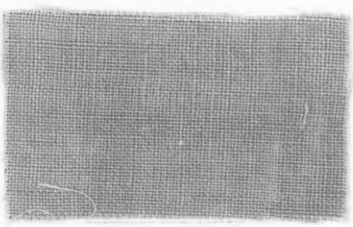
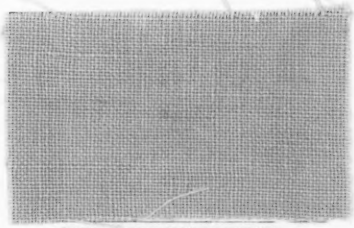


PONSOL BLUE BCS PASTE
PADDED IN A REDUCED FORM



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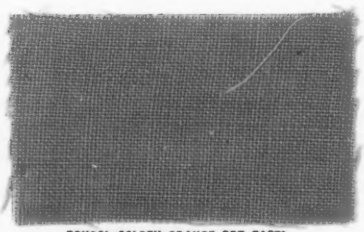
PADDED IN A REDUCED FORM



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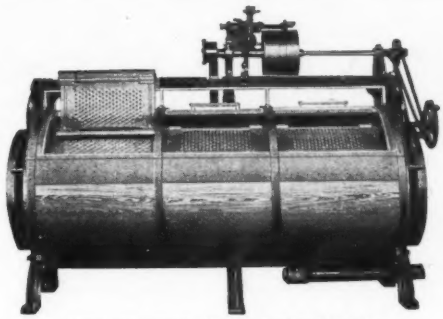

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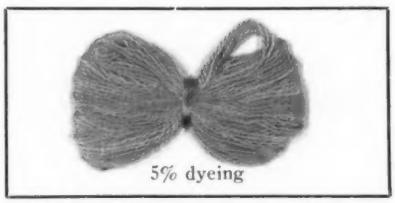
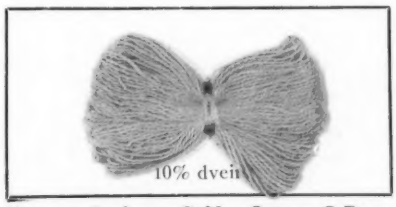


Newport Anthrene Pink FF Paste



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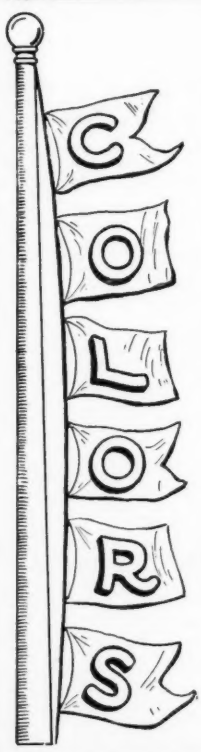

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assisted by
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VOLUME XIV JANUARY 26, 1925 NUMBER 1

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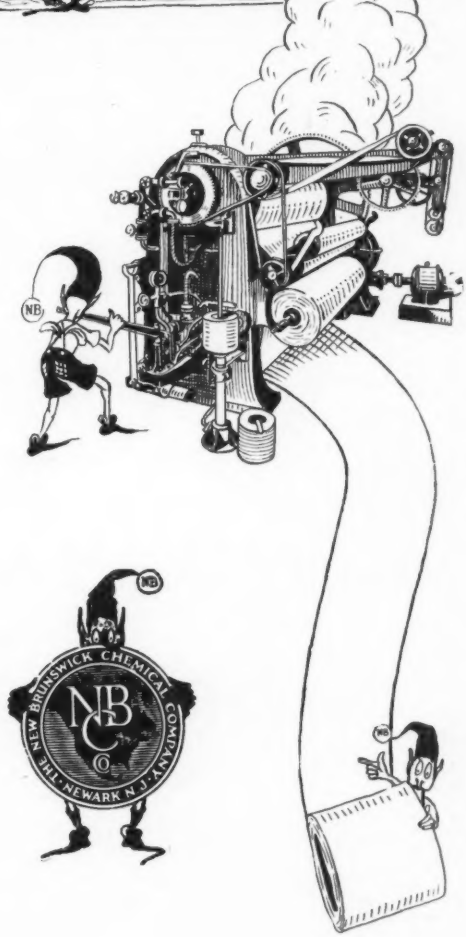

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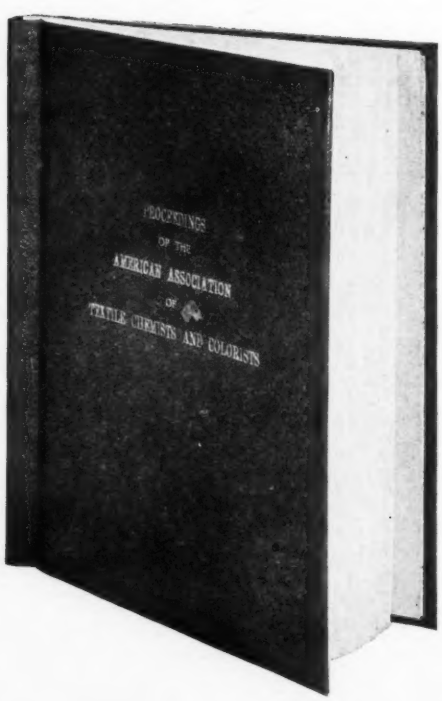

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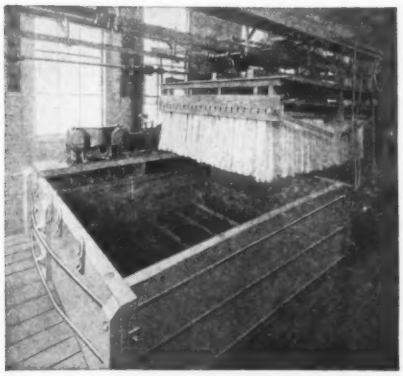

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VOLUME XIV NEW YORK, JANUARY 26, 1925 NUMBER 1

Notes on the Dyeing of Acetate Silk

The Dyeing, Beaching and Finishing of Acetate Silk* Alone and in Combination with Other Fibers—The Dyestuffs and Colors Employed—The Ionamines, Azonines and Azinils

By A. P. MARCH

THE chief difficulty experienced in the handling of acetate silk is its brittleness. This can be more or less overcome by keeping the silk in a moist condition. By so doing knots may be tied and the silk generally manipulated.

In the dye kettle smooth bamboo sticks must be used, the same as for any other artificial silk. Hand dyeing is the only method that will give satisfactory results as far as evenness and freedom from tangles is concerned. In piece dyeing the usual methods of dyeing may be followed.

SCOURING

When dyed in the skein it is advantageous to scour with 2 pounds of neutral soap per 100 gallons of water. A little ammonia may be added to the bath, but it is not recommended as the luster is affected. The temperature of the bath must not exceed 120 deg. Fahr., nor must the temperature of the dryer exceed 160 deg. Fahr. After working the lot in the soap liquor for twenty minutes it should be thoroughly rinsed and scoured in a weak formic acid bath (1 pound per 100 gallons).

BLEACHING

The silk itself may be bleached with ¾ deg. Tw. chloride of lime solution with good results. When combined with cotton and Viscose this method is the most satisfactory. When combined with silk or wool the peroxide method must be used. Fabrics containing Lustron may be mercerized if the concentration of the caustic soda is kept below 15 per cent, and the temperature below 40 deg. Fahr. The goods must be washed and scoured quickly.

DYEING

Lustron and Cotton Unions—Lustron, Cotton and Viscose Unions

(*A*) *Dyeing the Cotton and Viscose, Leaving the Lustron White.*—Lustron has a remarkable affinity for the basic colors even without mordant, but practically no affinity for the direct colors and acid colors. Therefore, in Lustron and cotton unions or in Lustron and Viscose unions, when it is desired to dye either the cotton or the Viscose and leave the Lustron white, the direct cotton colors should be used.

Goods should be scoured according to the directions given in the first paragraph. The volume of dye bath should be as large as can conveniently be manipulated. Common salt should be used as an assistant in preference to Glauber salt. Goods should be entered cold or luke warm and the temperature gradually brought up to not exceeding 175 deg. Fahr. It can be kept there until the dyeing is completed. Some of the Direct Browns, Reds and Greens have a tendency to stain the Lustron silk slightly, others do not. When these dyes are used it is better to add the dye in portions, and it is better not to add the salt at the starting of the dyeing, but after the bath has been brought up to temperature. Some of the Direct Cotton Blacks contain Chrysoidine or other basic dyes as an impurity or shading color, and such Direct Blacks should not be used because the Lustron will be dyed by the basic dye component. Erie Black NR and some of the Developed Blacks, like Diazine Black BH and Diazo Black BHS, leave the Lustron silk quite clean. Combinations of the BH Blacks with some of the Direct Yellows and Direct Oranges which in soap baths leave natural silk white produce a good black on Viscose and mercerized cotton, leaving the Lustron a clean white.

(*B*) *Dyeing Lustron and Cotton Unions, Leaving the Cotton White.*—Goods should be scoured and bleached as directed above. The dye bath should be as large as possible. The basic dyes should be used and 5 to 10 per cent formic acid on the weight of the goods. The goods should be entered cold or lukewarm and the temperature gradually raised to 150 to 170 deg. Fahr. If after dyeing a small amount of basic color still tints the cotton, the goods can be cleared in a hot weak lactic acid bath. One or more clearings may be necessary. If a pure white is desired on the cotton, an additional clearing with a very weak, warm soap bath, followed by a cold, weak sodium hypochlorite bleach will give a good white on the cotton.

*The acetate silk referred to in this article is the product of the Lustron Company

The sodium hypochlorite bleach should be about half as strong as the one described under the paragraph on bleaching. The goods should be scoured and neutralized as prescribed.

(*C*) *Cross Dyeing Lustron and Cotton Unions.*—Dye the Lustron as described under *B*. For medium or dark shades on the cotton, a single acid clearing after dyeing a Lustron ought to be sufficient. Wash out the acid and dye the cotton with a direct cotton color as in *A*, adding a very small amount of bicarbonate of soda to the bath.

(*D*) *Solid Colors on Lustron and Cotton Unions.*—(a) Dye the Lustron as under *B*, with the basic colors. Wash free from acid and fill up the cotton, using the direct colors.

(b) Dye both the fibers with the Janus colors. (These can be secured from H. A. Metz & Co.) In using the Janus colors the cotton will take the color on at a different rate, depending on whether it is unbleached, bleached or mercerized, while the Lustron will take it on always at practically the same rate. The Janus colors go on cotton better somewhat below the boil, while Lustron will take the Janus colors better at the boil. When using these colors, therefore, the dyer will have to use his judgment as to dyeing conditions, depending on the character of the cotton used.

(c) Mordant the fabric first in the usual way, with tannin and antimony, then dye with the basic colors.

Lustron, Cotton and Natural Silk Unions

(*E*) *Dyeing the Cotton and Silk Different Colors, Leaving the Lustron White.*—Dye the silk with acid colors in a bath made slightly acid with lactic acid. Wash out the acid, neutralize with a little bicarbonate of soda. Dye the cotton with a direct cotton color, selecting those colors which do not stain the silk. The reverse method can be applied where it is preferable, that is, dye the cotton first with a direct cotton color which doesn't stain the silk and then dye the silk with an acid color in a weak lactic acid bath.

(*F*) *Dyeing the Cotton and Silk the Same Color, Leaving the Lustron White.*—Dye the fabric with those direct cotton colors which dye the same shade or practically the same shade on the cotton and the natural silk, such as Benzopurpurine, Chrysophenine, etc., or dye the natural silk with acid colors as above, and then fill up the cotton with direct cotton colors, which give the same or practically the same color on the cotton as the acid color gives on the silk; or dye the cotton first with a direct color in a salt, soap and soda bath, and then dye the real silk with an acid color.

(*G*) *Dyeing the Real Silk and the Lustron, Leaving the Cotton White.*—The real silk and the Lustron can be dyed in the same bath with a small amount of lactic acid, using a basic dye which gives the desired shade on the Lustron and an acid color which gives the desired shade on the silk. The dyeing conditions and coloring should be the same as under *B* except that the bleaching should be omitted, and if a clearing with the soap is given, acid colors should be picked out which are fairly fast to soaping.

Instead of dyeing in a union bath, the basic color can be put on the Lustron first and then the acid color on the real silk.

(*H*) *Dyeing the Cotton and Lustron, Leaving the Real Silk White.*—Dye the Lustron with a basic dye with a little lactic acid. Clear with a weak lactic acid bath, wash, rinse in a very dilute bicarbonate of soda solution, and then dye the cotton with a direct cotton color, which doesn't dye the silk in a salt, soap and soda bath.

(*I*) *Dyeing All Three Fibers Different Colors.*—Dye the real silk and the Lustron as in *G*. Clear with lactic acid, wash, then dye the cotton with a direct cotton color which doesn't dye the real silk, or better, dye the Lustron first with a basic dye, clear, then dye the cotton with a direct dye which doesn't dye the real silk in a salt, soap and soda bath, then dye the real silk with an acid color.

NOTES

Wool, Cotton and Lustron Unions.—The wool and cotton can be dyed with the regular union colors, and the Lustron will stay white or practically so, provided no basic dye is used in the union. By the addition of a small amount of basic dye to the union dye bath, the Lustron can be dyed any desired shade.

Indanthrenes and Sulphur Colors.—The Indanthrenes or vat colors dye only pale shades on Lustron. The alkalinity of the bath should be kept as low as possible. By gradually raising the temperature to a moderate degree, full vat shades can be put on Lustron yarns. Continuous working is necessary for level shades. This treatment will impair somewhat the waterproof character of the Lustron although even after the dyeing it will be at least twice as strong as other artificial silks when wet.

Sulphur colors can be dyed on cotton grounds containing Lustron stripes by dyeing at a very low temperature, making the dye bath very strong in color, as weak as possible in sodium sulphide, and making the dyeing time as short as possible to get the desired shade. There will be very little staining of the Lustron provided temperature and alkalinity are kept low. However, these processes saponify the Lustron to some extent and are not recommended.

Viscose and Lustron.—When Viscose or any of the other ordinary types of artificial silk are in the fabric the dyeing of these can be accomplished the same as under the directions for dyeing the cotton.

Mineral Acids.—Mineral acids, viz., sulphuric acid, hydrochloric acid, etc., should not be used in dyeing fabrics containing Lustron; acetic, lactic and tartaric acids can be used. Formic acid is fast growing in favor.

Neutralizing.—It is recommended after dyeing has been accomplished and the goods are rinsed that they be soaked for about fifteen minutes in a cold ¼ to 1 per cent bicar-

bonate of soda bath, and be hydroextracted and dried without rinsing. On account of this recommendation it is desirable to select types when available which will not strip or bleed during hydro-extracting and drying.

Basic Dyes on Lustron.—Lustron has a peculiar and individual affinity for the basic dyes even in the cold, the affinity varying with individual dyes. No previous mordanting is necessary. Organic acids, common salt, Glauber salt, sodium acetate, etc., retard the dyeing rate and can be used where necessary for good leveling. Better leveling is also secured by dyeing medium to full shades rather than pale shades.

The basic colors on Lustron show good fastness to soaping and excellent fastness to acids. Some of these dyes on Lustron also show excellent fastness to light. The order of fastness is noticeably different from the same dyes on cotton. All basics are fast to acid with the exception of Vesuvine and Chrysoidine.

Good Light Fastness.—Night Blue, Brill-Cresyl Blue 2B, Brill-Cresyl Blue 6B, Turquoise Blue, Capri Blue GON, Cresyl Blue 2RS, Victoria Green WB, Methylene Green B, Brilliant Green B, Janus Yellow, Rosazein, Magenta, Malachite Green, Tannocyanine, Setocyanine.

Fair Light Fastness.—Crystal and Methyl Violet, Fast Blue RS (Meldola Blue), Thioflavine T, Auramine (in heavy shades), Victoria Blue.

Other common basic dyes show moderate to poor light fastness.

Fast to Hot Soap.—Brilliant Green Crystals (National), Acridine Orange (Ciba), Acridine Red 3B (Carbic), Pyronine B (Carbic), Methyl Heliotrope O (Metz), Setocyanine (Geigy), Night Blue.

Acid Colors.—So far as we have found, these acid colors will dye Lustron: Victoria Yellow O, Amido Yellow E, Orange 1V, Alizarine Direct Violet R, ER, Alizarine Direct Blue, SE, Acid Alizarine Gray B (Metz), Terra Cotta RS (Geigy), Violet PDH (Carbic), Modern Violet (Carbic), Acid Rhodamine (Ciba), India Yellow GA (Grasselli), or Azo Yellow A5W (National), Coomassie Fast Violet 10BP (Levinstein).

These are dyed with the addition of a small amount of acetic acid and 10 to 15 per cent common salt. In goods containing cotton, the cotton may be stained somewhat but can be cleared either by a hot, weak acetic acid bath alone, or such a bath followed by a lukewarm soap bath. Coomassie Fast Violet is only moderately fast to light. Indian Yellow is fast but reddens in shade. Acid Rhodamine is fairly fast.

Chrome Colors.—Alizarine Yellow R (Grasselli) or Chrome Orange R (Metz), Alizarol Orange R (National), Pontachrome Yellow 3R (Du Pont), Alizarine Yellow 2G (Grasselli) or equivalent, Auto Chrome Olive Brown G.

The above chrome colors dye on Lustron with acetic acid and salt like the acid colors, and the cotton can be cleared in the same way. Basic dyes can be added to the dye bath to secure different combinations. For example, in dyeing a light-fast green, we use Alizarine Yellow R and either Victoria Green WB or Methylene Green B added directly to the dye bath with the chrome color. Both these basic greens are of good fastness to light on Lustron. When the basic color is used in conjunction with the chrome color, it is well not to add any salt to the dye bath until after the basic dye has been exhausted therefrom. Unless it is desired to restrain the rate at which the basic dye feeds on to the Lustron, as common salt exercises a very marked restraining action on the basics; or preferably the basic dye can be put on first cold with or without addition of salt and acetic acid, and when the bath is exhausted the chrome color can be added and dyeing continued to shade.

Alizarine Colors.—Alizarine Red Pastes 20 per cent Y and B shades (Grasselli and National), Alizarine Orange RP (National), Alizarine Orange AO (Klipstein), Alizarine Cyanine AK (Klipstein), Alizarine Blue S (K. and P.), Alizarine Violet ZBS (Zinnser & Co.), Alizarine Violet Z4B (Zinnser & Co.), Alizarine Brown ZW Marks (Zinnser & Co.), Anthracene Blues.

All the above Alizarines, in which we have included Anthracene Blue, dye on Lustron in different manners. Alizarine Red can be used to obtain either a gold on Lustron or a purple, depending on the method of dyeing. To dye a gold use 4 per cent Alizarine Red Y, 2 per cent tannin, 1 per cent acetic acid, 20 per cent salt, and dye for a full hour at 175 deg. Fahr. Clear the cotton with one or two baths containing a slight amount of acetic acid, wash and then soap *cold* for about fifteen minutes with 1 per cent bicarbonate of soda and 1 per cent soap on the weight of the goods. If the shade is a little too glaring, it can be dulled or browned a bit by substituting cream of tartar for the acetic acid in the dyeing formula; or run cold after dyeing in a solution of one pound soda ash and 1 pound soap in 120 gallons water until desired brown is obtained.

To dye a purple with Alizarine Red use 2 per cent Alizarine Red and just enough acetic acid so that the dye bath will stay orange and not red when hot. Dye for one hour, clear the cotton with hot water and then run the goods at 175 deg. Fahr. with 5 per cent Turkey Red oil (soda) slightly overneutralized with ammonia. This treatment should be continued until the silk has come to its final shade, but at any rate, if it comes quickly, the red oil treatment should be continued for half an hour at least, in order that the color shall be fully developed through the fiber and keep its shade on drying.

Alizarine Blue S is dyed at 150 deg. Fahr., not higher for one hour with 1 per cent acetic and 15 per cent common salt, and 6 per cent chromium acetate liquor 32 deg. Tw. 2 to 4 per cent of color should be used. The bath will exhaust fairly well. After dyeing the goods are rinsed and then steamed for one hour without pressure, after which they are cleared in a hot bath containing 1 per cent soap and 1 per cent soda ash.

The Alizarine Violets and the Alizarine Browns are dyed in a bath with a small amount of acetic acid and common salt. The progress of the dyeing can be de-

termined by spotting the goods with a little ammonia, as the color does not develop in the acid bath. After the goods are dyed they are rinsed and then developed with Turkey Red oil and ammonia, the same as for the purple shade of Alizarine Red.

Anthracene Blue is dyed as an acid color with acetic acid and salt. It can also be dyed in a bath containing a small amount of soap and soda, in which case it will dye the Lustron a lavender and the cotton a dull blue. Neither Alizarine Blue S nor Anthracene Blue leaves the cotton very clean. Alizarine Blue S can be brightened by topping it, after the clearing and washing operation, in a hot, neutral bath with a mixture of Crystal Violet and Victoria Green. In dyeing the basics, however, on the Lustron it is better to start the dye bath cold or lukewarm, and then gradually raise the temperature to exhaustion.

Direct Colors.—Practically all the Direct Blues, including Diazo Black BH and Diazo Black RS, leave Lustron very clean, with the exception of Fast Blue RW, which stains it noticeably. Practically all the Direct Yellows, Direct Oranges and Direct Reds leave Lustron clean. Most of the Direct Greens and Direct Browns stain Lustron considerably, but the amount of staining can be minimized by feeding the direct color to the bath slowly. Fast Brown M (Newport) and MB (Newport) do, however, leave Lustron quite clean. Of the Direct Blacks, only Erie Black NR Extra (National) and Dianol Fast Black DL and Direct Black GS (Diamine Black HW) leave Lustron clean. Where a large amount of these Direct Blacks is required to get a full shade on the cotton, it is advisable also to feed the color to the dye bath slowly so as to keep the concentration down. Primuline will dye Lustron, but cannot be developed to a full red, being overcast by the Bismarck Brown, etc., formed in the developing process, since it must be carried out at 140 deg. Fahr. in a soluble oil bath.

Sulphur Colors.—Sulphur Black can be dyed on cotton, leaving the Lustron clean, if dyed as follows: For 100 pounds of dye bath use 1 pound Sulphogene Carbon H Black (Du Pont)), 2 to 2¼ pounds of sodium sulphide crystals, ¼ pound of soda ash and ¼ to ½ pound common salt. Dye at a temperature not exceeding 75 deg. Fahr.; 68 deg. would be better. A full shade should be procured in one hour to one hour and a quarter.

The important point to remember in dyeing the Sulphur Blacks is to keep the temperature and the alkalinity as low as possible.

IONAMINES—AZONINES—AZINILS

The Ionoamines (Levinstein) are in the same class as Azinils (Metz) and Azonines (K. & P.).

The same instructions hold for all. An example of the different shades procured by different developers follows:

	Azonine G	Yellow
	Azonine R and Phenol	Gold
	Azonine R and Resorcine	Red Brown
	Azonine R and Beta-Naphthol	Scarlet
	Azonine R and Dev. O. N.	Red
	Azonine 2R	Yellow
	Azonine 2R and Resorcine	Red Brown
	Azonine 2R and Beta-Naphthol	Scarlet
	Azonine 2R and Dev. O. N.	Maroon
	Azonine B and Dev. O. N.	Blue
	Azonine S and Phenol	Brown
	Azonine S and Resorcine	Dark Purple
	Azonine S and Beta-Naphthol	Purple
1%	Azonine S and Dev. O. H.	Gray Blue
3%	Azonine S and Dev. O. N.	Black

(Dev. O. N. is beta-oxy-naphthoic acid.)

Azonine G on Acetate Silk

Directions for Dyeing

The dyestuff is dissolved in boiling-hot water and added to the dye bath through a sieve or filter. Dyeing of the acetate silk is carried out for approximately three-quarters of an hour at about 60 to 70 deg. Cent. (140 to 160 deg. Fahr.) with the addition of 3 to 10 per cent acetic acid.

The dye bath is not completely exhausted and may advantageously be made use of for dyeing further lots.

Azonine R, 2R, B and S on Acetate Silk

Directions for Dyeing

Dissolving.—The dyestuffs are boiled with about 100 times the volume of water and the addition of hydrochloric acid required for each particular product, the solution being passed through a sieve or filter into the dye bath, heated to 60 deg. Cent. (140 deg. Fahr.).

The following quantities of hydrochloric acid are required:

For Azonine R an equal quantity—viz., 1 pound hydrochloric acid 340 Tw. per 1 pound dyestuff.

For Azonine 2RO, eight times the quantity—viz., 13 ounces hydrochloric acid 340 Tw. per 1 pound dyestuff.

For Azonine BO, six times the quantity—viz., 9½ ounces hydrochloric acid 340 Tw. per 1 pound dyestuff.

For Azonine SO, six times the quantity—viz., 9½ ounces hydrochloric acid 340 Tw. per 1 pound dyestuff.

Dyeing.—Not less than 30 to 40 times the volume of liquor, calculated on the weight of the silk, should be used for dyeing.

If hard water, or water otherwise showing an alkaline reaction, be employed, it should, previous to adding the color solutions, be acidulated with hydrochloric acid so as to just react feebly acid.

In case of light shades, with a view to facilitating leveling, a further addition of O, 2O, 5 per cent hydrochloric acid, reckoned on the weight of the goods, is an advantage.

(*Concluded on page* 63)

Proceedings of the American Association of Textile Chemists and Colorists

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Brown Mahon, Chairman, Judson Mills, Greenville, S. C.
Harry W. Ormand, Secretary, Union Bleachery, Greenville, S. C.

FOURTH ANNUAL MEETING

[EDITOR'S NOTE—*The following is a full report of the session held in the Philadelphia Textile School Saturday afternoon, December* 6, 1924. *The proceedings of the Saturday morning session, including the papers presented during that session, appeared in the issue of January* 12. *A complete report of the Saturday evening Banquet Session appeared in the proceedings of December* 29.]

SATURDAY AFTERNOON SESSION

December 6, 1924

The Saturday afternoon session of the Fourth Annual Meeting convened in the auditorium of the Philadelphia Textile School at 2.15 o'clock, Prof. Louis A. Olney, President, presiding.

President Olney—One of the most popular calls, on the questionnaires which were sent out to determine the subjects that the members would like considered at the meeting to-day, was for a discussion of the whole subject of artificial silk, and so the Council voted to devote the entire afternoon meeting to this subject. We appointed a special committee, of which Dr. E. H. Killheffer was Chairman, to work up the program for this afternoon, and we are to have a symposium which we believe will quite thoroughly cover the subject, as we have made an effort to have all the different types represented. We thought that we could do no better than to have Professor Hibbert introduce the subject of artificial silk this afternoon, and give us a more or less general and comprehensive talk in regard to it. I think we are very fortunate indeed in having Professor Hibbert with us. He has made a very thorough study of cellulose chemistry and the various practical applications of cellulose; I believe no one is better qualified to talk to us along this line. It gives me great pleasure to introduce Professor Harold Hibbert of Yale University.

Composition and Properties of Various Artificial Silks

By PROF. HAROLD HIBBERT
Of Yale University

I wish to talk to you on the subject of recent work on the structure of cellulose and its bearing on the manufacture and properties of artificial silk, and in order that this journal may have something to report that will be of interest to the general readers I am going to take about three minutes to give you some statistics indicating the importance to the industry of a study of the subject of cellulose and products relating to artificial silk.

The domestic production of artificial silk in 1913 amounted to 1,566,000 pounds. This had grown in 1923 to 35,000,000. The imports are only 3,906,000, so that this is no longer an infant industry but one well sustained and well established.

On the other hand, the imports of natural raw silk have also shown a most remarkable growth, from 28,000,000 pounds in 1913 to approximately 50,000,000 in 1923. The total value of silk manufactures during 1921 was $583,000,000, and is much larger for 1924.

Compare this with the rate of growth of the population, from 96,000,000 in 1913 to 110,000,000 in 1923, representing an increase of 14,000,000, and you will see that it represents an average consumption for man, woman and

child of approximately one-third of a pound of artificial silk.

We pass on to the question of modern views on the structure of cellulose, and I wish to outline as briefly as I can the recent work which has been carried out on the structure of cellulose.

Recent Developments

What have been the recent developments in the field of the chemistry of cellulose? First of all, we now know definitely that cellulose is to be regarded as a derivative of sugar, or ordinary glucose. To be more accurate, cellulose is a derivative of dehydrated glucose; or, to put it scientifically, it consists of nothing more than anhydro-glucose molecules. This has been established beyond doubt by the work of such men as Irvine, Willstaetter and Zechmeister, and Ost, Monier Williams and others, whose researches prove that cellulose can readily be converted into glucose quantitatively. When I say "quantitatively" I am referring to yields of as high as 95 per cent glucose.

If this is the case, then we must consider the bearing of such facts on the constitution of cellulose and the significance of such facts for the textile chemist.

First of all, what do we know about the cellulose molecule? It is derived from anhydro-glucose. Secondly, it contains three hydroxyl groups to each glucose residue. Thirdly, it contains a *latent* aldehyde group; and, fourthly, it is a natural plant product which at the same time is a colloid. These facts have been definitely established.

I don't need to emphasize the role played by these hydroxyl groups just now. We all admit that we can make a triacetate, trinitrate and other products, but what has been lost sight of in recent work, and the point to which our own researches at Yale have given special attention, is the importance of this third factor, namely, this latent aldehyde group.

You must accept from me as proven that instead of glucose being represented by the older formula (five hydroxyls connected with an aldehyde group) modern research has shown the correct formula for glucose is this: (Illustrated on blackboard.) All that has happened is that in the straight chain compound, which I can write out in this way, a hydrogen here has wandered to this position, giving us the product which I now write. Glucose is to be regarded as an equilibrium mixture of the two products.

We know that the plant is able in some manner to transform sugar into cellulose; that is, to remove water from the molecule, as shown by the change: $6_6H_{12}O_6 - H_2O = C_6H_{10}O_5$.

But there at once arises the problem as to how this water is split off. The most reactive part of the molecule is this particular hydroxyl group (indicating on board) which, to use a scientific term, is what is known as "aldehydrol." This, you see, can split off water from here, or these two can go, or we can split off from here and here. (Illustrating.)

Some ten years ago, on the basis of theoretical studies, at a time when the constitution of cellulose was altogether unknown, I ventured the opinion that in view of the reactions undergone by similarly constituted organic compounds, the reaction must take place as indicated to give us what I term the cellulose unit which in its polymerized form would represent the cellulose complex, the ring closing by the loss of water. (Illustrating.) On the other hand, as I pointed out shortly afterward, two or more of these units may join up to give us a cellulose nucleus, as assumed by what we might term the "German school of thought," represented by Heuser, Pringsheim and Karrer. If three of this type are joined together we have the formula proposed by Irvine. (Illustrating.)

I cannot spend much time discussing any of these except to say that at the present time we don't know which one is correct, and for the purposes of discussion, gentlemen, it is immaterial, so that all I will ask you to do is to bear in mind two or three facts: firstly, that what we are dealing with in cellulose is a product in which we have three hydroxyl groups to each C_6 unit; of these two are secondary and one is primary in character; secondly, we have a *latent* aldehyde group, and thirdly, we are dealing with a natural plant product which is a colloid.

Accepting these facts, let us see what deductions and commercial applications may be drawn from them. First of all, consider the fact that the cellulose molecule contains three hydroxyl groups. We know these three groups are there because we can make a triacetate (which is Celanese); a trinitrate, from which Chardonnet silk is prepared, and we can obtain a variety of other trialkylated or acylated derivatives.

Cellulose thus shows all the properties of a trihydroxy alcohol. Furthermore, it behaves as any ordinary alcohol does. For instance, we know that if we dissolve copper sulphate in ammonia, we form copper ammonium sulphate, and this solution has the remarkable property of reacting with polyhydroxy derivatives because copper has a very extraordinary affinity for the hydroxy group in organic compounds. It is thus not surprising that cellulose dissolves readily in copper ammonium sulphate, because it is a polyhydroxy derivative, and this change is, as you know, the basis of the process for making Cuprammonium artificial silk.

Another point is the fact that cellulose reacts with alkalies. Any alcohol, which I may represent as ROH, will react with caustic soda to give us an equilibrium

mixture of what we term an alcoholate and water. This (illustrating) would be our alcoholate, and excess of water would decompose it; excess of caustic soda, on the other hand, would give us a larger amount of alcoholate. In the same way, cellulose can replace this radical and we get a caustic soda derivative of an alcohol, namely, cellulose alcohol.

Sodium ethylate, which I must write as C_2H_5ONa, has the remarkable property of at once entering into reaction when brought into contact with carbon bisulphide, giving us sodium xanthate.

Soda cellulose reacts in the same manner, giving sodium cellulose xanthate, a product readily soluble in dilute alkalies. (The various reactions were illustrated on the board.)

These reactions represent the changes involved in the viscose process for the manufacture of artificial silk. The alkaline solution of the cellulose is forced through the spinneret and then decomposed by contact with an acid "setting bath," thus regenerating cellulose.

There is thus a thoroughgoing analogy between the properties of cellulose and those of ordinary ethyl alcohol.

Oxycellulose

I will now take up the remaining point, namely, the bearing of the latent aldehyde group. However, before I pass on I wish to say a few words with regard to the question of oxycellulose. If I write the formula down once more in this way, we note that when we subject our polymerized derivative, our cellulose, to the action of an oxidizing agent, our knowledge of organic chemistry tells us that this group (indicating) is far more reactive than either this or this. For instance, in the case of glycerine, with which you are more familiar, when you treat this product with caustic soda, your salt formation takes place at this point (indicating), so in the case of cellulose if we bleach in either neutral or alkaline solution, we are concerned with the ease with which a primary alcohol group undergoes oxidation in the customary manner, first of all to an aldehyde group, and secondly, to an acid.

Consider for a moment the effect of various reagents with reference to this latent aldehyde group. If I write the formula for glucose in this way (illustrating), then we can, by the action of methyl alcohol and hydrochloric acid readily convert it into what is known as a "glucoside," which is distinguished from glucose because it contains no free aldehyde group. That is the point which you must bear in mind.

Such derivatives are quite stable toward alkalies but are readily decomposed by dilute acids.

If you examine the structure of cellulose which is before you, what you are dealing with is nothing more nor less than a glucose glucoside of glucose, and knowing this we are able to predict a good many of the properties of cellulose. Thus, we should expect it to be stable toward alkalies. On the other hand, we should expect it to be unstable toward acids because all derivatives of this type which are very similar to the products to which we, ourselves, have devoted considerable attention (namely, what I term "acyclic acetals"), are made by the combination of an aldehyde with a polyhydroxy derivative. We have done considerable work in this field, and I can summarize by saying that cellulose closely represents, in its chemical properties, a cyclic acetal, this latter being characterized first of all by the ease with which the free aldehyde group is formed with dilute acids, and secondly, its remarkable stability toward alkalies.

Structure of Cellulose

Before passing on to the question of artificial silk and outlining in a general way its properties, I think it might be well to discuss the results which have been recently obtained abroad in the Faserstoff Institute, Berlin, with regard to the stucture of cellulose and other fibers as shown by X-ray analysis. This is not the place to go into the detail of this work, except to say that by taking X-ray photographs of cotton fibers it has been possible to show that cellulose probably has a "building unit" of quite small molecular proportions, probably of the order of $(C_6H_{10}O_5)_4$, and that such a product is capable of combining with itself to give a derivative of much higher molecular weight, which we know as ordinary cotton cellulose. This is not in conformity with Irvine's results, in which we have three units, nor is it in conformity with other researches, so that the question must be left open.

Nevertheless, this work has already given us quite an important insight into the properties of the cotton molecule. In the first place, it teaches us that cotton cellulose is not, as we have previously assumed, a simple colloid substance; it is what we term a crystallite, and judging from the evidence available cotton cellulose would seem to consist of these crystalline aggregates of cellulose, which form the skeleton of the fiber, seated in a magma of amorphous material produced from a previously liquid product. In other words, you must look at your fiber as a series of these crystallite aggregates in this magma, and this has many advantages. It allows, for instance, reactions to occur between these crystallites and many reagents. If all of these crystallites are arranged parallel to the axis, as seems to be the case in cotton, this accounts for the strength of the cotton fiber.

These results are borne out by an examination of the

various types of artificial silk. For instance, in Viscose silk after precipitation of the cotton (hydrated cotton), these crystallites, instead of all being arranged parallel to the axis, are arranged in topsy-turvy fashion as contrasted with, say, the cellulose which we obtain by the Chardonnet process.

The important thing is that to obtain strength we have got to have our crystallites running parallel to the main axis; and it is of interest also to know that, in mercerization, when we mercerize without tension and then examine the mercerized product after removal of the alkali, we find the same thing as in Viscose: they are arranged all higgledy-piggledy. If we mercerize under tension, they remain parallel to the axis, in this way (illustrating).

You can see that such a method of analysis offers considerable promise with regard to the future of the subject, and it is much to be regretted, as has been so often the case, that America's contribution to this field is nil; that she still remains a parasite on European scientific thought and inventiveness, and has contributed little or nothing in the past to the development of the subject of the newer processes for the manufacture of artificial silk. I cannot refrain from mentioning this to this gathering of textile chemists, and until the day arrives when we are willing to devote more of our time and means to contributing our fair share to the underlying scientific work in the field it will always remain a stigma upon the American textile industry.

Two Classes of Artificial Silks

Now to pass over to artificial silks. These may be divided into two classes. In the first we are dealing with cellulose derivatives rather than cellulose itself, and I shall include in this class acetate silks such as Celanese and Lustron. In the second class belong the hydrated cotton products (cellulose hydrates), in which we may include Chardonnet, Viscose, Cuprammonium and Thiocyanate silks. I propose to discuss the various types of artificial silk on the lines of this classification.

First of all, to produce artificial silk what do we require? The manufacture of artificial silk, speaking generally, is merely a reproduction of the part played by the silk worm; in other words, the emission of a liquid which is capable of undergoing solidification to form a thread. For this purpose we require a solution of cellulose which can be forced through fine orifices in what we term the "spinneret," consisting of a small glass or platinum cylinder, one end of which is closed, but fitted with a considerable number (varying in quantity) of very fine orifices, through which you force your cellulose solution. The thread is then forced into a precipitating bath, which brings about the precipitation of the cellulose; or it may actually be rolled off on a spool in the form of the original cellulose derivative and then decomposed later.

In moving from cellulose to cellulose acetate we have passed from an alcohol to what we know as an ester; in other words, this cellulose acetate no longer contains the free hydroxyl groups.

What is the effect of removing these hydroxyl groups and replacing them by an acid such as acetic acid? Well, we know that hydroxyl groups denote hygroscopic character. Glycerine is a trihydroxyl alcohol; it contains three hydroxyls. If we form triacetin or glycerine triacetate our hygroscopic character disappears, so that as we pass from cellulose to cellulose triacetate we should expect the product to be much less hygroscopic in character than the original cellulose; and, as you know, this is the case.

On the other hand, it has this drawback: the ability of cotton to absorb dyes or to yield a dyed fabric is intimately associated with the presence of these same hydroxyl groups, so that by the removal of them we take away its tinctorial absorptive power; and, as you know from experience, this has been somewhat of a difficulty with regard to the technical application of cellulose acetate. Through intensive research on the part of the manufacturers of Celanese, it has fortunately been found possible to overcome this drawback by the use of a new series of dyestuffs—their own invention. It must not be imagined, however, that the *final* solution has been found and much still remains to be done in the way of "activating" or producing a greater affinity as between the cellulose acetate and the dyestuff. Since the residual affinity of the former is presumably located essentially in the carbonyl group of the acetyl radical, it is in the increased activation of this that in all probability the solution will be found.

Of further interest is the fact that cellulose acetate must be more stable in many ways than ordinary Viscose, Chardonnet or Cuprammonium silk. I do not think there is any doubt about this, because with the derivatives of Class 2 the result of producing artificial silk is that we have a product in which the colloidal surface of the cotton molecule has been very considerably activated. Consequently, Viscose is much more susceptible than the original cotton to oxidation, to the action of acid and to changes in various forms. At the same time it must be remembered that, due to the presence of the acetyl groups, cellulose acetate is readily acted upon by alkalies.

I am not sufficiently aware, but I hope this afternoon we may have it made quite clear (perhaps it is asking too much), as to the relative difference between Lustron and Celanese.

If we wish to increase the affinity for dyestuffs of an acetate silk without changing its chemical character, apart from the method already outlined—namely, activation of the acetyl group in the triacetate—there are two ways in which this can be done. In the first place, we may incom-

pletely acetylate our cellulose; in other words, leave a certain proportion of the hydroxyl groups free. Such a product naturally possesses increased attractive power for dyestuffs. Or we may do the reverse operation: we may take our triacetate silk and hydrolyze it by means of alkali, in this way liberating some of the hydroxyl groups and by this means effecting the same result. However, we must not make the mistake of assuming that by preparing an acetate silk, say, with the same percentage of acetic acid, on the one hand by an acetylation process and on the other hand by the removal of acytol groups, we shall get the same product. This is an error which I know has been made by textile chemists. You cannot expect, in the nature of things, that such should be the case, and I will just call your attention to the fact that when we acetylate cellulose, as I pointed out, we are dealing with a product containing one primary and two secondary alcohol groups. The acetylation proceeds in a manner proportionate to the activities of those two classes of groups, and this same activity is, naturally, different in the reverse operation—namely, removal of those groups—and it is thus not to be expected that the two processes will yield the same end-product.

Chardonnet and Cuprammonium

I shall now pass over to the second class, which includes Chardonnet, Viscose, Cuprammonium and Thiocyanate silk. First, with regard to Chardonnet silk: the process in brief consists in nitrating cotton in which our hydroxyl groups are replaced by nitrate groups by treating with a mixture of sulphuric and nitric acids, thus converting the cotton into guncotton, which is cellulose trinitrate. This is dissolved in a mixture of ether and alcohol, forced through the spinneret, spun dry, and the fiber then subjected to what is termed a denitrating process to convert the cellulose trinitrate back again into hydrated cellulose. The reagent commonly used for this purpose is ammonium sulphide.

With regard to Viscose silk, Dr. Mitscherling will go into this in detail, so it is unnecessary for me to say more on the subject except to point out that the process consists, first, in the formation of soda cellulosate; secondly, conversion of this into cellulose xanthate by means of the action of carbon bisulphide; solution of this in alkali, and the forcing of this solution through a spinneret into an acid bath (so-called "setting bath"), which brings about the precipitation of the cellulose hydrate.

In the Cuprammonium process the cotton is dissolved in a basic ammoniacal solution of cupric hydroxide. While there is not much of this type of silk manufactured abroad, its production in this country is being rapidly developed and the fiber should compare favorably with either Chardonnet or Viscose. It is essentially a question of the cost of production.

It is a remarkable fact that Germany cannot compete with Belgium with respect to the Chardonnet process, and has also apparently abandoned the Cuprammonium method, concentrating entirely on Viscose. On the other hand, the Belgian industrialists have made a big success of the Chardonnet process both in Belgium and in America.

At the present time the largest production is undoubtedly that associated with Viscose silk, and notable improvements are being made as regards quality and nature of the product. Thus certain European firms intend producing Viscose silk of much finer counts than have been made previously.

In the Chardonnet and Cuprammonium processes cotton is employed exclusively, while in Viscose manufactured wood pulp is employed. The question of the quality of the wood pulp is of the greatest importance, as can be readily attested by workers in this field. Fortunately, it is now possible to obtain high-grade material in Canada and America, and in view of the intensive research work planned by several of these leading companies there would seem to be every prospect of a still greater improvement in the character of the raw material.

Lastly, the thiocyanate process, while not as yet a commercial success, offers certain possibilities. The cotton dissolves readily, and good material has been made experimentally.

I think, gentlemen, my time is almost up. At least, I would prefer to close at this stage by again drawing your attention to the fact that unless we do something to keep abreast of the scientific developments which are being carried on abroad, we shall not remain in the front rank in this industry. I will only recall to your attention that apparently a considerable portion of the resources of the Faserstoff Institute in Germany have now been devoted to a study of fibers and their properties. Far more attention is being given to this subject than to that of the development of nitrogen fixation. We seem to have reversed the process in America. We are willing to grant millions of dollars for nitrogen fixation (the Government is), and yet, as far as I can judge, even the Bureau of Standards requires money in order to help the textile chemist with his problems.

The entire industry in its various operations, such as dyeing, bleaching, the production of new textiles and textile effects, the combination of the various new textiles; the important subject of mercerization, etc., now demands not merely an empirical knowledge of the cotton molecule but an up-to-date general knowledge of its peculiar chemical and physical properties, structure and characteristics. Of fundamental importance, also, is the proper selection, growth and cultivation of the cotton fiber. Certain species, as is known, are much more adaptable to mercerizing effects

than others. With a proper selection, it is reasonable to predict that improved and new methods of mercerization will be found, resulting in the production of new textiles, likely to prove formidable competitors to the present types of artificial silk.

If you consider the fact that the trend of textile development, as relates to cotton spinning, is now distinctly toward the South, that while the production of new spindles in the North during the last twenty-four years has averaged something like 300 per cent, in the South it now amounts to something like 3,000 per cent, so that we have approximately the same number of cotton spindles running in both North and South, it is quite evident that if this industry is to continue to flourish in the North it can only be by considerable attention being focussed on the possibilities of these new textiles from what I might term the New England standpoint.

Your society has already made a start in supporting the Bureau of Standards. I hope that you can persuade your members to enlarge that support. It is certainly true that if we do not do our share, the textile industry is bound to fall behind that of Europe and we shall have to pay dearly for it later on.

Thank you. (Applause.)

President Olney—Professor Hibbert has certainly given us an excellent background upon which to present the subject of these individual silks which for the most part, I believe, will be represented in this afternoon's program. I think, however, that we would do well to postpone any discussion until after we have heard the presentation of these different silks by the various men who are on the program to discuss the subject.

We will reverse the program somewhat because the original speaker on Viscose silk (that is, the gentleman whose name appears on the program) is not with us, and we will go down to the other end and call upon Mr. Dicks who will present the subject, "Cuprammonium Silk." Mr. R. P. Dicks, president of Cupra, Inc. (Applause.)

Cuprammonium Silk and the Artificial Silk Industry

By R. P. Dicks

President, Cupra, Inc.

Gentlemen, I didn't come down here to stand before you as an expert on the manufacture of artificial silk. The real purpose of this visit is to expose a gentleman whom you know quite well, our mutual friend, Dr. Killheffer. Some six or eight weeks ago he called me on the telephone and asked me if I would come down and presume to address this meeting. I did so with the distinct understanding that Dr. Killheffer would let me know about the matter some six or eight days in advance, and all the doctor did for me was to find me with a broken arm and notify me to the effect last evening at six o'clock that I was going to have the privilege of addressing this meeting. I hope that the punishment fits the crime. (Laughter.)

Gentlemen, this is a subject on which I have unfortunately had to do a great deal of hard work. I claim no special knowledge, except that I do know how to make silk spin and make it dye properly and work well. The research chemist can do and must do enormous work in the field of producing a more stable solution. The most stable that I know of is the cuprammonia solution, when it comes to the question of handling. For that simple reason I have utilized that procedure in making silk.

The next step is a realization that chemistry is an exact science, a realization that if Viscose solution were made exactly the same way each and every time, you would get identically the same results, and it is presumed that you will do that, whether or not you make Viscose, Cuprammonium or the acetate group, to the same degree that if you use the same dyestuff in the same proportion at the same temperature with the same amount of material, you should receive the same results.

Following that procedure, we have probably stressed more the mechanical feature of the manufacture of silk than the chemical, always on the assumption that we would produce a clean solution of Cuprammonium silk.

The next and biggest step was to get away from the problem of tearing our silk, and we worked hand in glove with the dyestuff people on that. We are not working for one another; we are working for the man who must spin that silk and put it into a clean fabric economically to deliver to your trade. In order to accomplish that, we have had to go through a long period of getting our silk to the point where it would not handle badly.

After that, we were greatly interested in having it handled properly by the dyer. He knows, and we all know that Cuprammonium silk has greater attraction for dyestuffs than Viscose silk. Naturally, it requires a little more resist in its application, but if handled in the right manner it will give you the same results with possibly a shade deeper color. Nevertheless, in the production of our silk we have found from time to time that we were not as clean—I mean as free from copper and other salts as we should be—and immediately there was a difference in the dyeing. When those matters were eliminated, we came to the point where we found that it was necessary to have uniform tension on the silk as it was dried, otherwise we would get two effects.

The manufacturer of real silk or other silk is familiar with the change in color or reflection of light due to the height of the luster, and if you have in your drying two

different tensions you will get two different appearances of color in the dyed product.

Those are things that are, after all, mechanical and are problems which are familiar to all silk manufacturers. I venture the opinion that all artificial silk made by the various groups that the Doctor mentioned would dye uniformly if the following procedure were rigidly adhered to, namely: first clean the silk properly of all foreign matters (and that is my problem, or any other silk manufacturer's problem). Step number 2 is to dry that silk under uniform tension before it leaves your hands. Step number 3 is for the dyer: in his manipulation, to be exact as to his dye bath in every particular; and finally, it is necessary for him to be exact in his drying.

It is needless for me to attempt to tell this gathering how to dye silk or any other fabric. I don't know, but I do know that if these things which I have just referred to are done, you will get uniform results.

I think you might like to hear one or two of the things that have been most interesting to me in connection with the manufacture of artificial silk. One of them was in connection with this very question of dyeing. I recall that we sent to a certain dyehouse some beautiful soft silk. It was sent down and dyed and they pronounced it as uniform as Viscose, which they said was one hundred per cent. But they said, "This silk turns hard; it looks as though it were wearing. It was soft when we received it and it is as hard as a board now."

I looked at it and more than agreed with them. After some investigation, I found that the dyer had very carefully taken the skein after he had dyed it and batted it around on the pole a few times, then hung it in a high temperature and dried it to a crisp. I asked if he treated Viscose in the same manner, which he did, and he obtained the same startling results.

The answer to the gentleman's problem would be, after dyeing this silk and whizzing it, to put it in a normal temperature, without opening it up, as they say, until it dries, not drying it at a very high temperature. Otherwise, it seems to set the fiber and produce the result I just described.

Another difficulty with this silk, and there are many (a great many more than a lot of us would like to admit) is the fact that in handling the silk in the dyehouse it is necessary to turn it continuously in the dye bath. All artificial silks are tender when wet, some more than others, but they are all tender.

The dyer is performing a service for some plant who must take that skein (and I am speaking of skein dyeing) and he must handle it in such a way as to permit of its being successfully unwound from that skein, in order that the customer or the dyehouse will be able to afford to unwind it.

The statement is commonly made to me by silk manufacturers (they use a great many different figures and how correct they all are, I do not know, but the common result is the same) that in direct proportion to the number of times you gentlemen in the dyeing industry subject artificial silk to dyeing the cost of winding that silk is increased. For example, a black winds a certain number of swifts. Let us say white from the silk manufacturer runs fifty; when it is dyed black, the same girl can run thirty. When it comes to running a sand or some color which is a combination of many colors, involving the fine art of the dyer, the same girl cannot run more than five, six or seven skeins at one time.

Certainly, there is some blame to be attached to the dyehouse at that point. It may be that the dyer is asked to get a shade on artificial silk that he shouldn't be asked to get, but certainly the dyehouse has done some damages to it and immediately there is a division of responsibility.

In producing silk for different purposes and making a solution, I said at the beginning that you are supposed to do a certain thing. You are. It might amuse you to hear of a discussion I listened to in our plant as to why there was a fall-off in viscosity and why a solution was acting peculiarly. It was very interesting and an extremely puzzling problem. I didn't know what was the matter and I was merely trying to find out, but this is what happened: I escaped from the gentlemen who were telling me about our difficulties and walked through to the mixing department. I observed that in the mixer in which this particular solution was resting there was an L-pipe which was evidence of the fact that a pipe fitter had been there that day. I listened and heard a little noise and then sent for the pipe cutter. It appeared that the pipe fitter (and it was shown to me why he did it) had failed to pack his valves efficiently and we had been spilling ammonium down and that I believe is why the viscosity fell off to nil.

That is the type of thing you are up against in any plant. It hooks right in with the matter of handling the silk in your dyehouse. That is the kind of mistakes that we make and those are the things we must eliminate.

Future of the Artificial Silk Industry

In connection with expressing an opinion as to the future of this industry I might cite an incident that occurred a few weeks ago. A gentleman that I know who directs and controls probably more spindles in the cotton mill industry than anyone else in the country gave me a figure that might be interesting to the Doctor. He did not give me this in the way of an apology but as a boast, as he is a North Carolina gentleman. He said that eighty-three per cent of the new spindles in the United States of America since the year 1914 have been built in the South, and the large majority of that eighty-three per cent have

been built in what is known as the Piedmont section of the Carolinas. This gentleman remarked to me after observing the operations at our plant (and he is a very thoughtful, studious man; I had the privilege of working under him for fourteen years and I know that he thinks twice and speaks once), "I have thought about this a great deal and I believe that this industry will almost supplant the production of ordinary cotton goods. What do you think about it?"

I don't agree with him, but at least that is the way his mind is running, and the development of your industry will be in the direction that the minds of men in his position run. To you gentlemen who are interested in the production of dyestuffs, who are interested in the dyeing of silk, cotton or wool, I will say, not as a warning but as a bit of advice, look well to your knowledge of dyeing this new thing, comparatively new in volume as evidenced by the figures which the Doctor has given, so that you may be ready to take care of that business as it comes to you. I don't know how much you know about it, but I do know that a large dyer of artificial silk said to me some months ago, "We confess, although we do this dyeing by the ton, there are hundreds of things we don't know about, and we are trying to learn every day; won't you tell us?"

I withdrew.

I have had considerable experience in the merchandising of cotton goods. That was my job in life before it became, by grim necessity, the pursuit of happiness and freedom through the manufacture of artificial silk.

Service and Appearance

The trade always buy two things: first, service—by service I mean durability of a fabric; second, appearance. You can't sell me a diamond in the rough. It may have the value there, but I want the appearance of that diamond; otherwise I won't buy it. If it were not for appearance, in which the trade is interested, none of you gentlemen would have on different colored suits or ties and you wouldn't wear different colored hats.

On the question of service: how much and how well artificial silk serves the wearer is very difficult for me to determine. I have had Cuprammonium silk, made by Cupra, worn in my household as a test against a two-dollar-and-a-quarter pair of silk stockings, and the Cuprammonium silk outwore the other, to my surprise. A gentleman whom I know (I am not at liberty to disclose his name, but he is a man of very large affairs and he is very much interested in one of the big industries here) told me that he wore out two linings of real silk against one of artificial in an overcoat that he put half-and-half in. I don't think that ought to be true, because artificial silk chafes and it hasn't the tensile strength per denier that real silk has. The only solution I have for that is that in the treatment of real silk they attempted to make two pounds of silk where one was delivered to the dyers. (Laughter.) When anybody does that, they are helping to throttle your industry.

People want durability of merchandise. You may think they want to buy entirely on the basis of price, but I will venture to say that the women of this country who wear the articles which all of us make (and they are the ones we work for) want service, the great majority of them, plus appearance.

Since real silk has already begun to be discredited by reason of the various methods of adulterating or increasing the poundage weight, thereby weakening the value of the merchandise to the consumer, and since cotton goods cannot reproduce the appearance or effect that silk has, you are really thrown into the arms of a product known as artificial silk, which thus far does not permit of the so-called loading or increasing in poundage. When it is discovered that that can be done in the artificial silk industry, it will be a bad thing for the industry in which I am interested.

An American Industry

For that reason, I am confident of the future of artificial silk, in spite of the fact that they do the research work in Europe, as the Doctor has said. And I beg to differ with the Doctor in his statement that we are a parasite upon that industry. I want you to understand, gentlemen, that I believe it to be an American industry, because the production of artificial silk is a volume production business, and that which is volume production is in itself an American business, because necessity has taught us in this country to forget the fine specialty work and to develop machinery and equipment that will enable us to pay a man a goodly wage and permit him to produce enough material so that he can draw that high wage and still allow us to compete at a price.

This product then to me represents, after all, a matter of careful common sense: to produce the same solution each time with accuracy, and, after that, spin it in volume, and by volume I mean poundage.

You can no more make money out of artificial silk at one hundred pounds a day or three hundred pounds a day at two dollars a pound than Mr. Henry Ford can afford to sell me his car at six hundred dollars if he made three hundred a day. So the industry is headed for big things. It isn't a business for men of small means, however ambitious they may be, to go into.

Those of us who were in business during the war had experience in making colors in powder plants—I did—and we know from experience that we can't pass into volume production until we get there and know what our

problems are. You can't know how much money it requires to put this industry over and on its feet. It can't be built up from a small thing to a large one. You have a minimum point at which you may stop and if you are fair to your industry, and if you are desirous of developing that industry, you should also have ample capital, not to learn how to make silk, but to improve the method which you employ at present to make silk. In that, your research chemist in co-operation with your mechanical engineer can play a most important part, and your company should, therefore, be in a position financially to maintain laboratories, because artificial silk is new; it is going to be improved so rapidly in the next ten years that you won't know it when you get it in the dyehouse, and in order for you to keep on the bandwagon it will be necessary for you to have this research work done and be able to finance it properly. When I say "research" I mean both mechanical and chemical. And until we come back to the fact that, after all, it is a humdrum matter of manufacture in the plant, and yet a very intricate matter and one susceptible of enormous improvement in the laboratories, we won't make the kind of progress in America that America has always made in any other industry that she has attempted.

I thank you, gentlemen.

President Olney—Mr. Dicks has certainly given us a very interesting and instructive talk in regard to his particular type of artificial silk and also problems of the artificial silk industry in general, and we thank him very sincerely.

We will next hear from Mr. Herbert Platt of the American Cellulose & Chemical Company. Mr. Platt. (Applause.)

Cellulose Acetate Silk—Celanese

By H. Platt

American Cellulose & Chemical Company

Mr. Chairman and Gentlemen—I have listened with a great deal of interest to Professor Hibbert and to Mr. Dicks and there are certain things which were said by the Professor which I cannot let pass. (Laughter.)

The first point was about the dyeing, a thing which we have gotten used to hearing about in the last three or four years. He says that Cellulose acetate cannot be dyed satisfactorily. In that connection a little later I will try and prove to you that research along the lines which Professor Hibbert pointed out has already been undertaken and a solution has been commercially arrived at.

Celanese is a comparatively new product or fiber; that is to say, five years ago there was no Celanese. There was a war industry for making cellulose acetates to be used as a protective coating for airplane wings. After the war, we were left with a large plant for making cellulose acetate, and no outlet, but through the foresight and imagination of Dr. Camille and Dr. Henry Dreyfuss we changed over this war industry to more peaceful pursuits, and thus we got Celanese, the new cellulose acetate art silk.

Appearance and Durability

The remarkable thing about Celanese is its appearance, a point which Mr. Dicks emphasized as being very necessary, as a yarn must have, in the first place, a good appearance. Secondly, Celanese has handling properties and it also has the other necessary qualifications, what has been called "service"; that is, it wears well and washes well.

We have heard that real silk weighted is not very durable. That is, tropical climates and prolonged exposure to light will rapidly deteriorate the fiber and cause it to disintegrate. In Celanese you have a fiber which not only stands up to the sun of tropical climates, but which will stand prolonged immersion in sea water. Admiralty tests show that after three months' immersion in sea water, it is in no way affected in strength, luster, elasticity; and what is more important, there are no growths whatsoever on the fiber. This shows that it isn't a food for bacteria, which I think is something rather different from all other textile fibers.

Another remarkable feature about the yarn is the fact that, like real silk, it has elasticity and elongation. All artificial silks have elongation, but Celanese is the only one that also has elasticity, which is a very important factor. It is produced in the usual denier, from three hundred downward, but Celanese is also produced in fine deniers, as low as forty denier, which is equivalent to a three thread thirteen fifteen real silk. That is carrying it very fine for artificial silk.

It may be interesting, as Celanese is a new fiber, to tell you how to identify it from other fibers. It is very simple. By taking a little of the thread and burning it, you can tell the ordinary regenerated cellulose because it burns similar to cotton. An acetate silk burns more like real silk, the difference being that the acetate silk runs up into a hard little knob at the end of the fiber whereas real silk burns and runs up into a knob which is soft and which you can squash between your fingers. Thus it is very easy to tell by that simple burning test whether you have an acetate silk or not.

I am not going to go into all the various uses of the product. Celanese is used in the white as yarn, and it is also yarn dyed—that is, dyed in the skein. It is wound without any difficulty; there are no swift winding difficulties. As Mr. Dicks said, it certainly requires careful handling, but then you have to do that with

real silk. I think there is rather an impression that artificial silk should be handled like cotton, and when the cotton dyer gets artificial silk he handles it like cotton. But when you get down to fine deniers like sixty and forty-five denier, it must be handled like real silk. If those precautions are taken, there will be no difficulty.

One great feature about the Celanese yarn is its regularity, and to demonstrate that I will show you a piece of fabric made of all Celanese yarn which you might pass around. That (passing sample around) rather demonstrates the regularity of the yarn. In that yarn there is a total range of denier of four per cent; that is, if you have a total denier, it is either forty-one or thirty-nine, and those are the outside limits. You can realize how important that is when you look at a real silk fabric, especially some of the stockings that are made nowadays. You see thick rings and thin rings in those stockings. That is simply due to irregular deniers, and you silk men will know that the reason for that is not in the making of the stocking but in the yarn itself.

The Dyeing of Celanese

Now I come to the dyeing of Celanese; most of the discussion so far seems to have centered around the dyeing.

Three years ago the dyeing of Celanese admittedly was difficult and for the dyer it was a heartbreaking job, and after trying out most of the already existing dyestuffs, it became very obvious that the only way to tackle the problem was to make dyestuffs which would dye Celanese, just as dyestuffs were made to dye cotton, wool and real silk. So it became obvious that it was necessary to make dyestuffs to fit the fiber which, after all, is the logical thing, because it is a new fiber, and it is different from wool or cotton or artificial silk which is of the regenerated cellulose type.

For some time we followed the method of removing some of the acetyl groups by what we call the "saponification process," and this, of course, did not give the same results as the diacetate. What we obtained was a small ring around the outside of the fiber of regenerated cellulose, being thick on the outside, and gradually diminishing to a core in the center of cellulose acetate. That process is difficult to control and the finished product is not to be compared with the unsaponified, as we call it, Celanese. So that two years ago saponification was dropped and we adopted a new method of dyeing Celanese with dyestuffs especially made to dye the fiber.

Dyes for Celanese

Whether these dyestuffs actually dye the fiber because of the acetyl group, I don't know; I wouldn't like to say that is the only cause of it, but what I do know is that now there is available a full range of what we call S R A dyestuffs, which will dye Celanese from lemon yellow through your oranges, and scarlets, to your violets, blue, navy blues and blacks. To-day, without difficulty, you can obtain any shade, depending, of course, on the skill of the dyer. It is like everything else; it is a new process and it has to be learned. You don't expect a man who has never seen artificial silk or regenerated artificial silk to go into a dyehouse and start dyeing it straightway. You know that is impossible, without running into trouble, and the same thing is true with Celanese. It is a new process and it has to be learned. It doesn't take long. It is simpler than most of the existing processes.

For instance, it is by no means a simple matter to dye vat colors; to dye shades the fastness of vat dyes would not be called simple, but when I tell you that most of the S R A dyestuffs, in light fastness, are approaching the vat dyes, and half of them are equal in light fastness to the vat dyes, you will realize that the colors do have fastness. These colors are not dyed by reducing; they are simply dyed direct on the fiber from a soap bath. These colors were not only selected for their fastness to light and washing and general fastness properties, but they were also selected for their level dyeing properties.

Another remarkable property of these dyestuffs is that they not only dye Celanese, but they do not dye cotton. They appear to have no affinity whatsoever for cellulose itself. They stain real silk; some of them leave it comparatively white. The oranges and the whites partly dye the real silk, but this is due in many cases to the fact that the dyestuffs will dye silk gum but not the silk fiber.

In our search for dyestuffs which would dye Celanese, it was only natural that we should strike many dyestuffs which do not dye Celanese, and it was found that most of the direct cotton colors leave Celanese undyed. Further inquiry into the matter showed that the staining in most cases was not due so much to the cotton color itself, but that it was due to impurities in that cotton color. I can give you an example: Most of the direct cotton blacks are made by using as one of the intermediates metaphenylene diamine, and this gives in the blacks a small quantity of impurity of Bismarck Brown.

Two Color Dyeing

Bismarck Brown stains Celanese brown, and that is why it is found that a large number of the direct cotton blacks, particularly of the E-Extra type, stain Celanese brown. But there is now in existence a complete range of cotton colors to be used on fabrics containing Celanese and cotton, the dyestuffs being especially purified so as to leave Celanese white.

Probably one of the most valuable properties that

Celanese possesses, from the point of view of the manufacturer of mixed fabrics of cotton and artificial silk, is this property which comes about through Celanese being dyed with direct cotton colors which do not dye the Celanese. By this method, it is possible to dye the Celanese one shade and the cotton another, by using the S R A dyestuffs for dyeing the Celanese and adding to the same bath your direct cotton colors which will dye your cotton. In that way, it is possible to obtain any two colors you want in one bath.

This has been done, you will say, with real silk and cotton for some time. Granted it has. But everyone knows that you do get certain staining which you have to overcome and you cannot obtain any two colors in one bath; you are limited on account of brightness. With Celanese you are not. There is no difficulty whatsoever.

I have a number of patterns here which might be handed around or examined later, showing these cross-dye effects. In some cases you will find that silk of the regenerated cellulose type has been used in place of the cotton, in which case it has dyed up the same color as the cotton ground. (Passed samples around.)

So far as the general action of Celanese is concerned with alkalies, as I pointed out, with strong alkalies you get a saponification effect; but with acids, it is remarkably stable. For instance, after treatment with, say, 2 to 4 c.c. of strong hydrochloric acid per liter at 85 deg. Cent. for a matter of two hours, it is entirely unaffected; and after that it will stand an acid bath of formic or acetic acid and will be in no way affected. This acid, of course, is necessary where you wish to obtain, like you do on real silk, the scroop finish. If you don't want the scroop finish, then you have no need for using the acid.

I shall not go further into the detail of these S R A dyestuffs because you will find in the last issue of the AMERICAN DYESTUFF REPORTER a very lengthy article by Dr. G. Holland Ellis who was the inventor of the process, and as most of you who read that journal know, he has put it far better than ever I could put it, so I will simply leave that for you to read.

Just before closing, I would like to hand around this pattern card which shows the complete range of S R A dyestuffs. It is rather interesting. That is the cotton card.

In conclusion, I might say that this product was only introduced in America about ten months ago, and it is finding application in practically every branch where real silk or artificial silk is used, and although probably some of you have heard of it, I can tell you this: that in the next twelve months you are certainly going to hear a great deal more about it. (Applause.)

President Olney—Mr. Platt has given us some excellent ideas on Celanese silk and I would like to say that I think he is very anxious to have those samples all back before you go. (Laughter.) They have been pretty well distributed here. Just be careful that they are all returned before you leave, if you please.

Mr. Platt—I just wish to offer a word of apology to Professor Hibbert. He has just corrected me. He did not say it was difficult to dye; he said that there had been difficulties. (Laughter.)

Professor Hibbert—I say this because I am a scientist and not a technical dyer.

President Olney—The next silk to consider, naturally, would be Lustron, and Mr. Royal Little is going to tell us about that. Mr. Little says he was christened without any middle initial but he has had about twenty given to him; we have given him the twenty-first on the printed program. Just cross that middle initial out.

Mr. Little—Mr. President, Members of the American Association of Textile Chemists and Colorists: This talk to-day I have planned to divide into two parts. In the first place, I was going to take up some of the uses of Lustron as a decorating fiber, giving the types of fabric in which it is employed, and then ending with an outline of dyeing methods and procedure, but inasmuch as the latter part is somewhat of a repetition of what has already been said before the Association (last year, for instance), I am not going to talk about that here to-day, as you will find it already published in the Proceedings of your Association (January 14, 1924, page 1).

. . . Mr. Little then presented his prepared paper, entitled "The Use of Lustron as a Decorating Fiber." . . .

The Use of Lustron as a Decorating Fiber

By ROYAL LITTLE

The Lustron Company

Lustron is primarily a decorating fiber. As such it is used largely to obtain cross-dyed effects in fabrics which are composed of two or more types of yarn. There are, of course, an infinite variety of color combinations, designs and constructions possible through the use of a fiber of this sort, but I am only going to discuss in a general way the different kinds of fabrics in which Lustron can be profitably employed.

Taking first, combinations of Lustron and cotton, there are the following woven cloths in which two-color effects are often desirable: Overdraperies, underwear fabrics, corset cloths, dress goods, all-cotton men's wear, and linings. In knit goods Lustron and cotton can be used advantageously together for novelty effects both in underwear and hosiery.

It is, of course, obvious to the textile colorist that, with as wide a diversity of fabrics as just mentioned, it is not possible always to use the same dyeing procedure or the same dyestuffs on two cloths in different classes, even though both contain Lustron and cotton and the same combination of colors is desired. Al-

most invariably each class of goods has some major requirement or problem to be solved which makes the dyeing and finishing of it slightly different from the next type of fabric.

Dyeing Various Combinations

In the case of cross-dyed overdraperies of Lustron and cotton, it is of prime importance that great care be used in selecting those dyestuffs for each fiber which show the best light fastness. In this class of goods the construction will vary from the lightest sort of marquisette to coarse, closely woven Jacquard designs, and the finishing requirements will consequently vary. This sample shows an attractive bit of overdrapery fabric of leno construction with a cotton warp and Lustron filling.

Cotton underwear fabrics are often made with Lustron warp stripes. The dyer's problem here is to get delicate shades on both the fibers and avoid the screaming contrasts which some cross-dyes require. Pinks, blues, lavenders and light greens are the best stripe colors to go with sympathetic grounds. It seems safe to say that unless there is a very marked change in styles, light fastness is of minor importance on these fabrics.

In Jacquard pattern corset cloths, in which Lustron and cotton are run pick and pick in the filling on a cotton warp, there are several interesting problems to be worked out. In the first place, practically all this business is in pink figures on a white ground, and a perfect match is required on pinks. Then the grounds must be well cleared. This is done by dyeing the goods in an acetic acid bath and running the temperature up close to the boil to insure complete exhaustion of the dye. A fresh clearing bath of acetic can be used if necessary.

In dress goods there is a tremendous variety of styles using the cross-dyed effects, and here we find other types of artificial silk and sometimes real silk used in conjunction with Lustron and cotton. The addition of the latter makes it possible to cross-dye into a three-color effect as shown by this voile sample. From the colorist's point of view the cross-dyeing of Lustron and cotton dress goods has fewer problems than any of the other groups. Light fastness requirements are usually not rigid, and the matching of shades is not so exacting as in some of the other types of goods. Also, the dyer can let his imagination run wild in selecting his combinations. One important point to bring out here is that Lustron and cotton mixed goods can be mercerized before cross-dyeing. This makes it possible to get a well-cleared ground on decorated voiles, for instance. Another interesting point is that by using both Lustron and Celanese as decorations on a cotton ground, the Lustron and cotton can be cross-dyed into any desired color combination and the Celanese left white (sample).

In all-cotton men's wear, otherwise known as "cotton worsteds," the goods are often dyed with sulphur colors. As Lustron can be either cross-dyed or left white in these fabrics, it is used for pencil stripes. The problem involved here is to prevent the sodium sulphide from saponifying the acetate. This is accomplished by carrying on the dyeing cold and lengthening the bath if necessary.

The cross-dyed lining field is a highly competitive one and dyeing charges are closely figured. As tussah is used extensively in these cloths, it is important for the dyer and finisher to bear in mind that when Lustron-filled linings came through they should not be finished like tussah. Tussah-filled goods are stretched a couple of inches over gray width to get the luster, and then hot-calendered to hold it. Lustron-filled goods do not need these treatments, and if given them the fabric will be tendered.

In knit underwear, and especially in hosiery, Lustron and cotton can be used advantageously. In underwear pale shades can be dyed on the cotton, leaving a resist effect of Lustron either twisted or plaited, while novelty effects that are very attractive are obtained by cross-dyeing Lustron and cotton hosiery. Besides the direct cotton dyes, sulphur colors can be used to advantage in dyeing this combination hosiery, leaving the Lustron white.

The next field is that in which wool and worsted are employed with Lustron. In this case, however, some other fiber, such as cotton or Viscose, is incorporated into the goods, and it is possible either to union-dye the animal and cellulose fibers or to cross-dye them into different colors. In the first instance a two-color effect is obtained, while the latter gives three colors. These combinations are largely limited to the dress goods and men's wear field. From the dyer's point of view, goods of this sort do not present as many problems as might be expected. There are, however, a few precautions which are necessary. If the goods are fulled, caustic soda should never be used. It is safe to have as high as a 5 per cent solution of soda ash, however, provided the temperature is kept under 140 deg. Fahr. The selection of dyestuffs is important especially in union-dyed goods where heavy shades are required. Some of these colors contain traces of basic impurities, which, of course, stain the Lustron; but all the large dyestuff manufacturers have lines of colors which are especially adapted for this work.

The silk goods field has endless possibilities for the use of Lustron in conjunction with real silk and other fibers. It is only natural, though, that the yardage

consumed of fancy silks of this sort should be small compared to the volume of decorated cotton goods. A cotton converter often runs as much as a million yards of a fancy style in the course of a year. Among the silk cloths in which Lustron can be used are linings, upholsteries, dress goods and necktie fabrics. The linings are usually of Jacquard pattern design, with an all-silk warp and alternate picks of Lustron and cotton or Lustron and Viscose. These goods are dyed into three-color effects after being boiled off as shown by these samples. The upholsteries and dress goods are either put into three-color combinations or the silk and cellulose fiiber are union-dyed, leaving the Lustron alone as the decoration. This latter procedure is of particular value in the case of combination crepes in which real silk and artificial are twisted together in making the crepe yarns. These fabrics, of course, have to be union-dyed, and Lustron is especially adapted to decorating such goods. As for necktie materials, bengalines and crepes using worsted and silk for a ground can be decorated in two colors by the use of Lustron and Viscose.

The colorist who has never done three-color work with Lustron may at first be overawed by the apparent complications. It is, however, quite simple provided he bears two things in mind: first, select colors which do not badly stain the other fibers, and, secondly, use only those dyes which will not strip and transfer to other fibers during subsequent cross-dyeing operations.

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I will now outline in a general way recommendations for the handling of Lustron goods:

Scouring

Fabrics containing Lustron and fibers other than real silk are scoured with 10 per cent neutral soap on the weight of the goods for fifteen to thirty minutes at a maximum temperature of 175 deg. Fahr. Never use caustic soda; and if the character of the goods demands some alkali, from 1 to 2 per cent of soda ash or small quantities of ammonia may be used.

Lustron fabrics containing real silk in the gum may be boiled off in one or two changes of a ¾ to 1 per cent neutral soap solution for about one hour without danger of impairing the brilliancy of the Lustron.

Mercerizing

It is often desirable to mercerize in the piece Lustron decorated cotton goods. This can be done in the usual mercerizing range with caustic soda solution of 20 per cent strength. Care should be taken to have the mercerizing bath as cold as possible, not over 40 deg. Fahr. In washing out the caustic soda, cold and not hot water should be used in the spirt pipes. Besides the water box, the range should be equipped with an acid box so that the goods can be run directly into the weak acetic acid—sulphuric should never be used. After coming off the range the goods should be thoroughly washed.

Dyeing

Lustron has a remarkable affinity for the basic colors without mordant, and can be dyed from a neutral bath, a slightly acid bath, or in the presence of common salt. The dyeing conditions vary according to the particular requirements. For instance, either acetic acid or common salt in small quantities retards the dyeing rate of the basic colors on Lustron. Acetic acid can be used where it is particularly important that other fibers present should not be stained by the basics. If no retarding agents are employed, the Lustron dye bath must be started cold to prevent the color going on the fiber too quickly. The bath is gradually raised until it is practically exhausted and the other fibers are clear. One interesting feature is that 1 per cent of practically any basic color will give a deep shade on Lustron.

In cross-dyeing Lustron and other fibers, such as cotton, it is important that the acetate silk be dyed first, as direct colors on cotton will mordant the basics.

In a fabric containing Lustron and Viscose, for example, where the basic bath is started cold the Viscose absorbs much of the basic color at low temperatures, and as the temperature is raised the dyestuff transfers gradually on to the Lustron. It is important, therefore, to bring the dye bath to a temperature sufficiently high to insure the Viscose or other fiber being clear. In this connection it is possible, if necessary, to raise the dye bath to a boil without affecting the luster of the Lustron. Should the other fibers still be badly stained after boiling the basic dye bath, a small quantity of acetic acid added at this point will clear them nicely.

In dyeing cotton or other fibers and leaving Lustron white it is, of course, necessary to select dyestuffs which do not stain the latter. In the case of the vegetable fibers, as a general rule those direct colors which leave real silk white do not stain Lustron, although there are many colors, such as Chrysophenine, which leave Lustron white that will dye real silk. As regards the acid colors which would be used to dye animal fibers in the presence of Lustron, there are very few of these which stain it at all. In using basics to cross-dye Lustron with any other fiber, a two-bath method is usually advisable for better control of shades, although considerable success has been obtained in single baths.

In dyeing three-color combinations, such as Lustron, Viscose and real silk, the Lustron should be dyed with basics first in a slightly acid bath, the Viscose second in a slightly alkaline bath with direct color and salt, followed by the real silk with acid color in a slightly acid bath with salt.

Upon the completion of any Lustron dyeings the goods should be rinsed for fifteen minutes cold in a solution of ½ ounce bicarbonate of soda per gallon of water. They should then be extracted and dried without further rinsing. This after-treatment is an insurance against the goods being left acid, and is of the utmost importance.

Dyestuffs for Lustron

The basic colors on Lustron show good fastness to soaping and excellent fastness to acids. Some of these dyes also show good fastness to light, the order of which is noticeably different from the same dyes on cotton:

Good for Light Fastness: Turquoise Blue, Setocyanine, Capri Blue GON, Cresyl Blue 2RS, Victoria Green WB, Methylene Green B, Brilliant Green B.

Fair Light Fastness: Cresyl and Methyl Violet, Fuchsine, Fast Blue RS, Thioflavine T, Auramine.

Other basic dyes show moderate to poor light fastness.

Special Dyeings on Cotton in the Presence of Lustron

Sulphur colors can be dyed on cotton leaving Lustron unstained if the temperature is below 75 deg. Fahr. and the sodium sulphide is slightly reduced.

In hosiery and wash goods, it is often of advantage to diazotize and develop colors on cotton, leaving Lustron white. It is, however, necessary to use Naphthol AS in order to do this, instead of the usual developers, such as beta-naphthol, which stains Lustron red, due to basic impurities.

The Indanthrene colors are not recommended for general use on Lustron, and have only limited application on union fabrics containing Lustron and other fibers.

In dyeing Lustron fabrics the following points should be borne in mind above all else:

1. Keep the alkalinity of the scour as low as possible.
2. Never use sulphuric acid, acetic being preferred in all cases.
3. Always give Lustron goods the bicarbonate of soda after-treatment.

Finishing

There are two precautions in connection with the finishing operation which should be observed in goods containing Lustron. In the first place, never stretch Lustron-filled goods over gray goods width. Secondly, do not run Lustron fabrics on bare copper cans previous to tendering, un ess the first two cans are lapped with cotton. Also do not run them through hot calenders. If these precautions are followed tendering of the fabric will be eliminated.

In summing up I wish to bring to your attention again the fact that it is possible to cross-dye into two-color effects Lustron and any other known textile fiber. Also, on account of its great affinity for basic colors and its unusual resist properties, the cross-dyeing problems of the colorist are reduced to a minimum. Upon these properties depends the success of Lustron as a decorating fiber.

President Olney—I am sure we have all been very much interested in Mr. Little's presentation of the subject of Lustron silk. We still have Viscose silk to hear about, but before I introduce the gentleman who is to speak upon that subject I wish to say a few words in regard to this silk spinning machine which has been so kindly shipped to Philadelphia and set up in this room by the Max Ams Company, which, I believe, represents the first attempt on the part of any American machinery manufacturers to build a machine for this purpose. I wish to express the appreciation and thanks of the Association, especially to Mr. Max Ams, president, and Mr. Brensinger, the vice-president, of the company for the interest they have taken and the trouble they have gone to and time they have spent in locating this machine here in the building and getting it into running order. I wish also to thank the Philadelphia Textile School for inviting us to have our afternoon meeting in this room, and especially Prof. Bertolet and Mr. Theel for the active part they have taken in making arrangements for this meeting.

Mr. W. W. Copper, who was to have spoken on Viscose silk, a representative of the Viscose Company, is ill and unable to be here. In his place, Dr. W. O. Mitscherling will tell us about Viscose silk.

The Viscose Process for the Manufacture of Artificial Silk

By Dr. W. O. Mitscherling
Consulting Chemical Engineer to the Max Ams Company

Professor Hibbert has explained the particular problems relating to the structure of cellulose, and it will be appreciated that we have to deal chemically with a very highly complex compound, and physically with a structure typically colloidal in character, capable of undergoing

decomposition into products of varying complexity, so that an analytical investigation involves exceptional difficulty. Scientifically, we know only one cellulose. Regardless of whether it is extracted from cotton, wood or other cellulose-containing material, we have a definite knowledge of, and can produce definite derivatives from, cellulose, but we do not know anything about the magnitude of the molecule. Of course, the altered physical condition associated with the ultimate fibers and cells, and the elimination of impurities and incrusting matters, changes somewhat the soluble complex, particularly when we subject the compound, cellulose, to the extreme action of alkalies or acids.

It would, of course, be impossible to go into a discussion of cellulose proper, its peculiarities, and the influence of impurities contained in the material as used for the manufacture of artificial silk.

The latter has won an unassailable position in the textile industry, and the most important process is undoubtedly the viscose process. The demands made upon the manufacturer of artificial silk, both with respect to uniformity and fineness, are increasing every day. It would seem that the technique of manufacture is far in advance of the chemical art. It is true, if unfortunate, that much of the technical research work carried out by manufacturers remains for obvious reasons unpublished, but work dealing with more general aspects of cellulose would only help the industry if made available.

The Material—Cotton and Wood Pulp

To produce artificial silk requires experience and capital. It is impossible to manufacture according to a certain formula. Practically every phase of the process offers difficulties, which can only be overcome by continuous scientific research.

As raw material, both cotton cellulose and wood pulp are being used. At the present time partially bleached sulphite pulp is preferred. The pulp must be free from lignin.

Naturally it makes a vast difference whether cotton or wood pulp is used. The characteristics of the two types are indicated in the following table:

	Cotton Cellulose	Wood Pulp
Per cent of cellulose in raw material	95 to 97	89 to 90
Magnitude of complex	Highly polymerized	Less polymerized
Hemi-cellulose content	Low	High
Condition of fiber	Very resistant	Less resistant
Viscosity under same conditions	High	Low

As we shall see later, control of viscosity is of immense importance, but uniform viscosity can only be maintained when the raw material is previously standardized so that it is always the same. Therefore, the utmost care must be exercised in the pretreatment of the raw material.

Artificial silk is produced on a tonnage basis. It is customary to use about a 7 per cent cellulose solution for spinning, with a viscosity of about one and one-half in comparison with normal castor oil at 20 deg. Cent.

The Process

The cellulose is immersed in aqueous caustic soda solution at 20 deg. Cent. and of a concentration ranging from 17.5 deg to 23 per cent NaOH, depending upon the character of the cellulose used. The excess of caustic soda is pressed out or extracted (either hydraulic presses or centrifuges are used commercially) to a point where the cellulose ratio to that of sodium hydrate stands in the following molecular ratio:

$$C_6 H_{10} O_5 : 2NaOH$$
$$162 : 80$$

This would represent theoretical proportions, but since 100 per cent cellulose is not being used in the manufacture of Viscose silk, theoretical proportions cannot be maintained. The analysis of the soda cellulose (depending upon type of cellulose used) is about as follows:

25 to 32 per cent cellulose
12.5 to 16 per cent NaOH
62 to 51 per cent H_2O

Viscose prepared efficiently from a very good commercial wood pulp would contain about 13 to 13.5 per cent NaOH. It is not necessary to say that the caustic soda must be practically free from carbonate. Mercerization temperature is 20 to 21 deg. Cent.

The only relation between the concentration of the caustic soda solution and the temperature is that considerably less concentrated caustic soda solutions can be used if the temperature is decreased, but this would make the soda cellulose too wet for xanthation.

The soaked and pressed pulp, now an alcoholate, is disintegrated in a Werner & Pfleiderer machine, after which it has the appearance of bread crumbs.

The soda cellulose is "aged" for from 24 to 48 hours, during which depolymerization and subsequent lowering of viscosity occur.

Formation of the Xanthate

More complicated is the formation of the xanthate.

Rotating drums are used for this operation. Theoretically, for each molecule cellulose one molecule CS_2 is required. Practically, however, considerably less CS_2 is

used. As a matter of fact, if the molecular ratio is followed throughout the process, the Viscose becomes very dark and the subsequent thread is also dark, or darker than usual. It becomes cream to light brown, rather than a light yellowish white, and it is very difficult to remove all sulphur compounds without subjecting same to very vigorous treatment. Frequently bleached Viscose silk will not dye level, particularly the light shades. This is due primarily to improper desulphurization. Even traces of sulphur compounds, not easily traceable by analysis, will cause this unlevel dyeing.

Xanthation is carried out at 20 deg. Cent. and is completed in thirty to forty-five minutes. The excess carbon bisulphide must be removed. The xanthate is soluble in water, but more readily in caustic soda solution. Usually caustic soda is added to the Viscose; that is, the Viscose is made up so that, for instance, a 7 per cent cellulose solution will finally contain 5 to 7 per cent caustic soda (including NaOH to form the alcoholate). Excess caustic soda preserves Viscose to a certain extent, and also insures normal and uniform maturing. It retards the speed of decomposition.

The next step is to mature Viscose. The decomposition process proceeds in four distinct stages. If we distinguish these steps by the ratios of Na : S : Cellulose, we find that the steps may be indicated by the ratios: First step, 1 : 2 : 1; second step, 1 : 2 : 2; third step, 1 : 2 : 4; fourth step, cellulose.

Maturity is usually tested by the use of a solution of ammonium chloride. The Viscose is tested every day and the number of cubic centimeters of ammonium chloride solution necessary to bring about precipitation recorded. It is customary to spin very mature solutions, or a Viscose representing the third step of decomposition, from 9 to 11 c.c. of ammonium chloride being required to jellify the Viscose.

Test—Chlorammonium solution, 10 per cent; Viscose, 20 g. + 30 g. H_2O. Mix the Viscose with water and add the ammonium chloride solution from a burette very slowly. Shake well after each addition of the ammonium chloride. Endpoint is shown by complete jellification. It will take some little experience to perform this test. Of course, while this is an arbitrary test, it is a very good control procedure for the factory. Since each plant operates differently, the number of cubic centimeters will be different with each type of Viscose, but with the same process the test will show at each progressive step of decomposition a definite number of cubic centimeters necessary to jellify the Viscose.

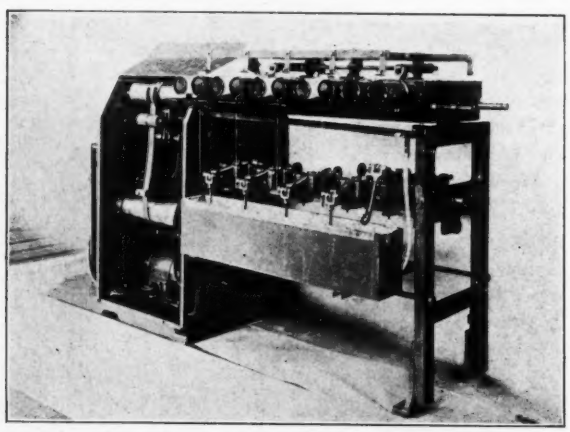

FIG. 1—*Spinning Machine*

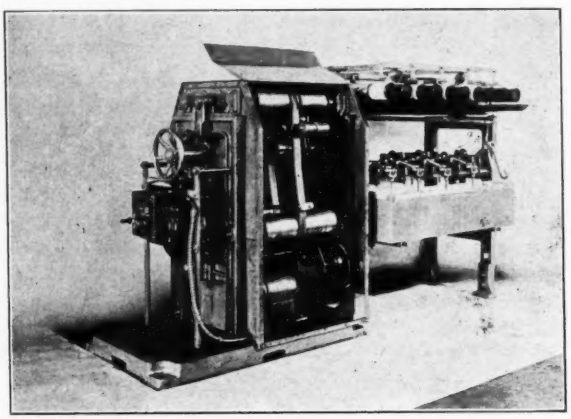

FIG. 2—*Spinning Machine—End View*

If the Viscose is matured at 20 deg. Cent. it will be suitable for spinning after seventy to ninety hours. Attempts have been made to spin very young Viscose, and it is claimed that much finer single filatures can be spun from this material.

THE SETTING BATH

For the setting bath, acids and acid salts are commonly used with or without the addition of sugars. The concentration of acid, usually sulphuric acid, is about from 9 to 15 per cent, and sodium sulphate of about the same concentration.

It is well to add to the bath glucose or another type of sugar, or hydroxyl compound, to retard the setting of the thread, or rather to effect selective setting. Some plants use a double setting bath; that is, they finish the setting by a weak sulphuric acid bath.

The acid is washed out, preferably by a vacuum rotary washer. With the latter it takes about one and a half to two hours (maximum) to wash a spool having 2,500 to 2,700 meters of silk of 150 denier. The consumption of water is 40 to 50 liters per pound

(maximum). With the newer type of washing machine the spools remain in a horizontal position, which is claimed to be an advantage, since the upper layer of silk does not become tangled, as is usually the case when the spools are washed vertically.

There are other means of washing spools—namely, the spray system—but this requires a very large amount of water and takes a long time. Approximately from 600 to 700 liters of water is required per pound of silk washed on spools by the spray system. Furthermore, fast washing has the advantage that the cellulose thread does not become slimy and the efficiency of the subsequent unwinding is much higher.

The spools are dried at about 50 to 60 deg. Cent. for two to three hours. Also here the vacuum washing process offers many advantages, in that considerably more water can be removed from the individual spool (about 50 to 60 per cent more), thus shortening the drying time.

After the spools are dried they are placed on spindles and the thread directly twisted. The spools must not revolve faster than 3,200 r.p.m. The usual twist is about 2.5 to 2.7 turns to the inch. The spools are then unwound into skeins on standard machines as used by the trade.

To remove the sulphur and sulphur compounds, the skeins are treated with hot sodium sulphide solution containing about 0.1 per cent sodium sulphide at a temperature of 60 to 80 deg. Cent. The skeins are then washed with water, finally bleached by the usual methods, and dried.

Another mode of spinning is that of "pot spinning." Silk has been produced very successfully by this process, but for lower deniers the spool-spinning process is superior.

Mechanism

Naturally, it is quite important that very good mechanical devices should be used for spinning. Speed, and a compensating speed, is necessary for the production of a high-grade silk.

[Lantern slides showing the construction of the spinning machine were explained. The various types of pumps were also shown on the screen.]

It has been customary, so far as we know, for manufacturing plants to construct their own machines, and naturally, since these plants only construct enough apparatus for their own requirements, the expense is very great; consequently the shop equipment entails quite an outlay of capital.

While there is no such thing as a standard spinning machine, the driving devices are more or less the same, and it is very essential that the spinning machine be constructed with a certain degree of flexibility so that it can be used with ease for different speeds to compensate for the difference in denier.

It is also necessary that a perfect system of lubrication be incorporated in the spinning machine and that uniform motions or movements are embodied. It should be possible to replace parts without stopping the machine. Provision should also be made enabling the operator to remove the spools without damaging the silk.

The metering device must be perfect, or as nearly so as possible, and easy to regulate, and the power consumption low.

Furthermore, loss of time and product must be

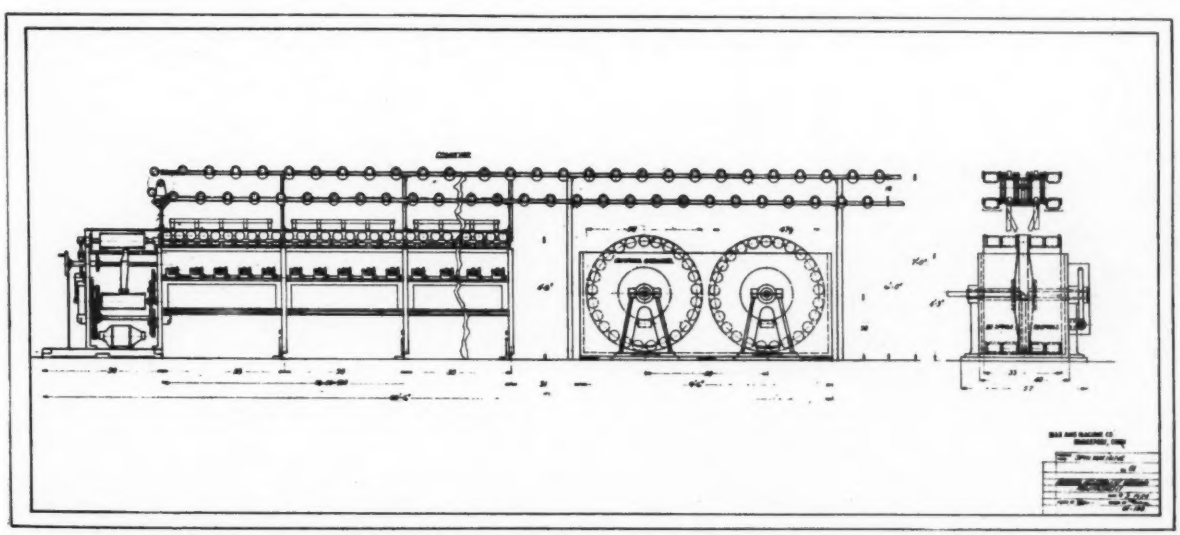

Fig. 3—*Assembly of Spinning Machine Connected withRotary Vacuum Washer*

avoided by constructing the spinning machine to enable the spinning thread to be easily thrown or transferred from the full spool to the empty spool so that the empty spool starts to function at the proper speed, since the winding diameter of the empty spool is considerably less than that of the full spool.

. . . At this stage Dr. Mitscherling illustrated the construction of the machine and its operation by a series of lantern slides, at the conclusion of which the machine was operated and the production of Viscose thread shown. Previously the manufacture of such machinery has been entirely a European industry, but with the growth of the manufacture of artificial silk in America, it is realized that undoubtedly the best results in the future, in so far as relates to mass production, will be obtained by the adaptation of native American ideas and mechanical ingenuity, as has been the case in so many other lines of industry. The textile industry of America can therefore feel grateful to the president of the Max Ams Machine Company, Mr. Max Ams, and Mr. Brensinger, the vice-president, for their decision to enter the field for manufacture of artificial silk machinery. Their well established reputation as manufacturers of machinery as used in the canning industry fits them in a peculiar measure to undertake such an enterprise. It would seem that in the machine exhibited some remarkable advantages have been brought out, both in construction and design, especially relating to the simplification of the pumps and the various mechanical devices developed with the object of obtaining uniformity in the spinning process. The machine shown at the meeting has been presented to Professor Hibbert, of Yale University, for the purpose of carrying out an extensive series of investigations looking toward improvements in the manufacture of artificial silk. . . .

President Olney—Gentlemen, as the hour is late and we must vacate this room right away owing to the fact that it is to be used for a banquet a little later, we will adjourn until the time of our banquet to-night.

. . . The meeting adjourned at 4.45 p. m. . . .

Report of the Sub-Committee on Light Fastness*

Submitted by WILLIAM H. CADY, *Sub-Committee Chairman*

Your Committee presented a report at a meeting of the Research Committee last spring, which was published in the 1924 Year Book of the Association but not in the Proceedings. As it is quite possible that this report has not been generally read, we take the liberty of quoting from it:

"Since making a preliminary report at the annual meeting at Providence, December 8, 1923, your committee has completed a second series of light exposures, comparing the fading action of the sun, the Violet Carbon arc, and the Mercury Vapor arc, the last two illuminants being considered the most promising of all artificial light sources tested to date. The samples exposed, composed of wool, cotton and silk, respectively, were dyed by a great variety of methods, including chrome colors both on a mordant and after-chromed, basic colors on a tannin mordant, direct colors after-treated with copper, sulphur colors, diazotized and developed colors, 'ice' colors, etc. Four sets of these samples were exposed to the Violet Carbon arc in Fade-ometers. Two sets were exposed to the Mercury Vapor arc with a glass shield in Cooper Hewitt fading lamps. Two sets were exposed to the sun under glass in New England cities.

"On comparing the results, we find little difference between the fadings made by the two types of artificial lamp, and for the most part only slight differences between these and the sun fadings. There are, however, a few cases where the sun has produced results quite different from the lamps. We endeavored to time the exposures to the sun so as to produce an average fading about equal to that of the lamp exposures. . . . It was also noted that two of the Violet Carbon arc exposure sets, although made in the same lamp under identical conditions about a month apart, showed a perceptible difference in the total fading, this difference applying to all the samples about equally, suggesting that the light during the two exposures was probably of a somewhat different intensity. The two Mercury Vapor lamps used also showed a difference in the rate of fading, one set of samples requiring only two-thirds as much time as the other."

Since making the above statement, your committee has examined a large number of samples of wool dyed with acid and chrome colors and exposed to the sun and the Fade-ometer. Owing to the fact that the sun tests were really "weather" tests, i. e., unprotected by glass, the comparison was not strictly fair, particularly in the case of the acid dyes; but a substantial agreement between the two sets of exposures could be observed in most cases. The conspicuous exceptions were two after-chromed colors, Erio Chrome Feranol R and Erio Chrome Cyanine R, which were almost entirely destroyed in the sun tests and were little affected by the Fade-ometer. These colors are being further investigated. Your committee has also examined the comparative fading action of the sun and the Fade-ometer on a large number of silk dyeings, and again finds much similarity. Erio Chrome Cyanine RC shows the greatest variation, going much redder in the sun but not in the Fade-ometer. On cotton the most conspicuous exceptions seem to be Dianisidine Blue (coupled), which fades badly in the sun and only slightly

*Presented at the Saturday morning session of the Fourth Annual Meeting, December 6, 1924.

in the Fade-ometer, and the Direct Yellows of which Benzo Fast Yellow 4GL is a type, which go very reddish in the Fade-ometer but not in the sun.

As it is a matter of considerable importance to determine the precise limits of accuracy of the Fade-ometer, owing to its increasing use by both producers and consumers, it seems advisable to extend this investigation and make sun and Fade-ometer tests of as many different colors as possible; and while your committee will continue to work along these lines, it is urgently requested that anyone who has compiled data on this subject, particularly in regard to abnormal colors, should communicate with the chairman at an early date, in order to avoid needless duplication of effort.

The purpose of this committee is to find a substitute for the sun, whose fading action will possess these three properties: (1) speed; (2) close similarity to the sun's action; (3) capacity for exact reproduction at different times and in different places. We believe that where extreme accuracy is not essential, the Fade-ometer may be considered a convenient substitute for the sun (except in the case of a few dyes such as the ones above mentioned, which in the absence of a definite explanation must be regarded merely as "abnormal"). The Mercury Vapor lamp with glass screen would appear to be about equal to the Fade-ometer in accuracy* so that the same number of hours of exposure will always produce approximately the same amount of fading action. We should add that fading tests made recently with the nitrogen-filled incandescent lamp, with suitable filter to cut out the excess yellow rays, indicate that this may be another promising source of light for this purpose, and further experiments are in progress at the Bureau of Standards to determine its possibilities.

Discussion

President Olney—You have heard this report, gentlemen. I am sure the Committee would be pleased to have a discussion in regard to it. Any questions that you may wish to ask or any suggestions you may wish to offer I am sure would be appreciated by the Committee. This is a very important subject and one which as yet has not been finally shaped up for the best use, perhaps, of the Association, but we trust that within another year it will be in final form for submission to the Association for official adoption.

Wm. F. Deady—I should like to ask how many hours of sun are equivalent to one hour of the fading lamp in that test.

Mr. Cady—We find, on the average, that five days of June sunlight are approximately equal to forty hours of the Fade-ometer. That is only an approximation, of course.

Mr. Deady—Do you take June sunlight as a standard? Suppose you are exposing in December; how many days more would you have to add?

Mr. Cady—I can't give any statistics on that point. It would be a great deal more, of course.

President Olney—That, of course, is one of the great advantages of an artificial light; if you once adopt that as a standard you have uniformity year in or year out, summer or winter, and it is some uniform system of this type we eventually hope to adopt.

Hugh Christison—In reply to that question about June or December sunlight, I have made quite a few exposures in different Junes and in different Decembers, and from those tests I believe that the fading is about two and a half times as much in June as it is in December.

President Olney—Are there any further remarks?

S. F. Carter—There was one thing that struck me in a number of these tests for fading and that was the matter of atmospheric conditions. We all know that light in a moist atmosphere hits a great many colors more than it does others. When I lived on the other side, we would send some colors to India or China or some place like that and expose them to light and note the difference in the result of exposure on those colors as compared with others. The difference in these results was entirely due to the humidity.

That seems to be a rather important point. It just struck me that perhaps we hadn't considered that.

President Olney—That is, the more moisture in the atmosphere, the more rapidly they will fade?

Mr. Carter—Yes, and I think that is something that ought not to be overlooked.

President Olney—Are there any other remarks? If not, Mr. Christison will tell us something about the work of the Committee on Fastness to Perspiration.

Hugh Christison—There is very little more that I can say in addition to what has already been published. What we are waiting for now is to try and see if different people will get approximately the same results with the same cloth, and working in the same way. Until we get that material, we will not make a final report.

*Further experimental work is in progress to determine whether or not this type of lamp can be operated.

NOTICE OF MEETING, NORTHERN NEW ENGLAND SECTION

The regular January meeting of the Northern New England Section of the American Association of Textile Chemists and Colorists will be held on Saturday evening, January 31, at the Engineers' Club, Boston, Mass. An informal dinner will be served at 5.30 o'clock.

A. E. Hirst, of the American Printing Company, and Dr. W. F. Scott, of Cheney Bros., will be the

speakers for the evening. Mr. Hirst will talk on "The Printing of Cotton Fabrics and Related Processes." Dr. Scott will take for his subject "Possible Applications of Hydrogen-ion Determinations in the Textile Industry."

Members from other sections are cordially invited to attend.

A. K. JOHNSON, Secretary.

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Dempsey, John C. H., demonstrator, Geigy Company, Philadelphia, Pa. Sponsors: D. P. Knowland and E. Ellssmann.

Esterly, William A., production supervisor, Vanity Fair Silk Mills, Reading, Pa. Sponsors: E. W. Wall and James A. Branegan.

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Stiegler, Dr. Harold W., research and instructor, Lowell Textile School, Lowell, Mass. Sponsors: L. A. Olney and William D. Livermore.

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Vellner, Frank A., textile chemist, Philadelphia Textile School, Philadelphia, Pa. Sponsors: Percival Theel and Elmer C. Bertolet.

ASSOCIATION BADGES

Those who attended the Annual Meeting at Providence had an opportunity to examine and purchase the new lapel button badges which were there distributed by the Secretary.

For the benefit of members who were unable to attend the meeting an illustration of the badge is shown herewith.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

WALTER E. HADLEY,
5 Mountain Avenue,
Maplewood, N. J.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

CLAYTON HOAGLAND
Managing Editor

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GUARANTEEING FAST DYES

THE daily papers of late have been giving considerable attention to reported exaggerations and misstatements made by the fabric manufacturers and jobbers in regard to claims for fastness of materials sold. Investigation leads to the conclusion that there can be no question that many goods, sold to the public on fastness guarantees made either by the retailer, the jobber or the manufacturer, are, in reality, dyed with fugitive colors.

This misrepresentation is purely a matter of merchandising methods and is outside the sphere of The REPORTER. It leads directly, however, to another problem which is of constantly growing importance to both dyestuff and textile manufacturers. This is the question of just where the responsibility of guaranteeing colors for fastness should finally rest.

There is no doubt that the public demand for fast colors is increasing in a remarkable manner. Never before in the history of textile dyeing have the requirements for fastness been so severe as at present, and from all indications this demand is likely to continue to spread until extreme color fastness will be insisted upon by the purchasers of practically all classes of textile fabrics.

There is to-day no longer any question that practically all classes of fabrics can be dyed so as to be fast to any reasonable tests which they are likely to encounter in ordinary use. It is simply a question of the selection of proper dyes, and proper methods of application and the willingness of the consumer to pay the price necessitated by the use of these colors and processes.

This fact being now generally accepted by both the public and distributors of textile fabrics, it is only natural that a demand for a guarantee of fastness should become increasingly prevalent. The ultimate consumer demands a guarantee from the retailer, the retailer expects a like guarantee from the jobber and the jobber in turn passes this responsibility on to the manufacturer. So far all is perfectly clear. The manufacturer or converter who has charge of the dyeing of the goods is in a position to know how they are dyed and processed and whether or not he can safely guarantee the colors.

There is now a disposition, however, for the textile manufacturer to go a step further and require that the dyestuff manufacturer, who furnishes the colors and who represents them to be fast, should assume, or at least share, the responsibility for the ultimate fastness of the fabrics when delivered to the consumer.

At first glance this demand seems reasonable. The dyer chooses the fastest colors known to him, but is guided in his selection of colors to a great extent by the sample cards and the representations of the dyestuff manufacturer from whom he buys. In many cases, particularly as regards fastness to light, it is impossible for the dyer to subject the dyestuffs which he purchases to practical tests to determine the correctness of the claims made by the dyestuff manufacturer. His orders must be filled promptly, and he cannot expose a dyed sample to the light of the sun for months in order to get an accurate light test, and the results obtained by the use of fading lamps are oftentimes misleading.

Up to this point it would seem as though the dyestuff manufacturer might properly be held responsible for any claims based upon a lack of fastness of goods dyed with colors which he had represented to be fast. Upon further consideration, however, it becomes obvious that so many matters outside of his control enter into the situation that any guarantee of final results on his part is not to be expected.

The dyestuff manufacturer can be assured that a certain dyestuff when it leaves his plant will, if properly applied in its pure state, produce colors of ample fastness. As soon as the shipment leaves his plant, however, the matter is beyond his control. Other colors may be added by the dyer, for the purpose of shading, or intentional adulteration may be resorted to. Moreover, the dyestuff, even though not shaded or adulterated, may be applied to a fabric for which it is not intended or by a method which will not produce fast results. When these factors are taken into consideration it appears obvious to us that no dyestuff manufacturer can be reasonably expected to assume or to share the burden of guaranteeing the fastness of fabrics dyed with his colors unless the actual dyeing operation is performed under the direction of one of his own demonstrators, which is, of course, impossible in a majority of cases.

It is possible that some of our readers may be able to suggest a plan by which the dyestuff manufacturer can safely guarantee the fastness of goods dyed with his products, but to us, in view of the reasons set forth above, it would appear to be difficult if not impossible.

There is no doubt, however, that this demand for a guarantee of fastness to all agencies on all classes of fabrics is one which is growing steadily, and the problem of who must accept final responsibility for such a guarantee is one which must be definitely settled. Practically all of the large mills which employ dyers and chemists of high practical and technical ability understand their problems so well that they have no hesitation in guarantee-

ing the fastness of their work, and hence have no occasion to "pass the buck" to the dyestuff manufacturer. Many smaller mills, however, who are not so favorably situated, and who have formed the habit of relying upon the dyestuff manufacturer for much of their technical information, see no reason why he should not be able to guarantee the fastness of colors produced with his products, and are inclined to look to him to assume or to share any claims for lack of fastness which they may receive from the ultimate consumer.

This whole subject is one of very considerable importance to both dyestuff and textile manufacturers, and we earnestly urge those of our readers who have constructive thoughts upon this subject to favor us with their comments in order that a full and open discussion of the subject may be had to the manifest advantage of all concerned.

A PIONEER IN THE FIGHT FOR COLOR STANDARDIZATION

ON another page is announced the release of a new card showing the popular standard textile colors for next spring. The card is issued by the Textile Color Card Association of the United States. The standardization of colors for apparel and for general decorative textiles marks another advance in the universal movement toward more efficient methods in manufacturing industries. To each industry in turn standardization has come to abolish confusion and waste. Its advocates, who silently and perseveringly strive to impose their doctrines upon industry, are content to remain obscure and unsung. Their procedure to establish standardization is usually subtle, methodical and successful. An association is formed and christened with a long, appalling title. Presently tons of printed matter begin to pour forth periodically and inevitably from the headquarters of the organization. This publicity is usually concentrated upon one industry, but standardization—whether of shoe boxes, tenpenny nails, hosiery or colors—is the keynote of it all; and lo! shortly the deed is done and standardization, with its brothers simplification, economy and efficiency, has been adopted by the members of that industry.

The Textile Color Card Association has had just such a success. The opposition it weathered during its early efforts has gradually been beaten down, not only with the printed word but with fruitful, convincing results that have demonstrated to the textile industry the value and importance of an organization that was fighting for a standardized line of colors to replace the confusing jumble of color shades and names prevailing a few years ago. Black was black, then as now, and white was white, but between lay chaos for the maker of colored fabrics, for the jobber and the retailer, and for the consumer.

The Color Card Association, fully cognizant of the work ahead of it and courageously adhering to its doctrines, set out to accomplish that work in spite of protests from those who opposed the adoption of a standard line of colors. The opposition maintained the right to label their merchandise by any color name they arbitrarily selected as an aid to the final sale of the product and to select a number of shades which should be "exclusive." They selfishly saw in the Association an enemy to their business. Colors and color names were regarded as private property; and what an array of them there was! But the Association, true to its doctrines and to the industry for which it was working, plugged on undaunted until its efforts have produced very decided and satisfying results.

The Association now issues periodically cards covering all standard hues, each systematically designated by an individual name and number, and supplementary shade cards for fall and spring showing new seasonable shades. Now not only is black still black, but sky blue is sky blue to the manufacturer, to the style authority and to the consumer. Most of the confusion arising from the designation and matching of shades has been dispelled by the persistent efforts of this one organization, working under the supervision of its managing director, Margaret Hayden Rorke. Those who a few years ago vigorously opposed the standardization of colors have now formed representative associations and groups to co-operate in the wider adoption of a standard color catalogue.

As a pioneer and as a persistent exponent of the doctrine of standardization, the Textile Color Card Association deserves much more recognition than it receives at present and much more credit for what it has accomplished than it will ever receive.

THREE NEW NEWPORT INSERTS

Three new leaflets for the Newport Binder describe Newport Direct Brown RG, Newport Fast Silk Gray GNB and Newport Thioflavine TG. Each sheet contains swatch bows dyed with the color described and gives notable properties and fastness specifications for each color.

The Direct Brown RG is suited for producing cheap browns and tans on yarns, cops, etc. Its fastness to steaming is described as excellent and it will discharge white. It has moderate fastness to light, washing, acids and alkalies. It is not suited for cross dyeing.

Newport Fast Silk Gray GNB is said to be excellent for dyeing yarns, piece goods, etc., because of its level dyeing quality and its exceptional fastness to washing, steaming and hot pressing. It has good light fastness but is not dischargeable.

Newport Thioflavine TG is extremely useful for the dyeing of natural silk or Viscose, Chardonnet, Cuprammonium and Lustron or Celanese artificial silks, producing a clear, greenish yellow with a greenish fluoresence. It is described as having good light fastness and excellent fastness to rubbing and steaming. It is said to be specially suitable for printing on cotton or natural silk, either direct or colored discharge styles and is also of interest for dyeing cotton over tannin mordant.

THE DYEING OF ACETATE SILK

(*Concluded from page* 40)

The baths exhaust well, so that standing baths do not come into consideration.

Azonine R, 2R and S, dyed direct, yield yellow and orange shades, and may be employed by themselves.

By diazotizing and developing on the fiber, shades are obtained varying dependent on the kind of developer chosen.

The three products may also be used in combination with one another.

Azonine B dyed direct is colorless, yielding a bright blue when diazotized and developed with Developer ON.

Diazotizing.—According to the depth of the shades, acetate silk for diazotizing is treated fifteen to twenty minutes in a cold bath charged with 2 to 4 per cent nitrite of soda and 5 to 10 per cent hydrochloric acid 34 deg. Tw., and rinsed immediately.

Developing.—After diazotizing and rinsing, the color is developed for twenty to thirty minutes in a bath heated to 45 to 60 deg. Cent. (115 to 140 deg. Fahr.) and charged, dependent on the depth of the shade, with 1 to 3 per cent of the respective developer, and rinsed again.

The shades produced with Azonine B require increased quantities of developers—viz., about double the amounts indicated for the other brands.

Preparation of the Developing Baths.—Phenol is dissolved direct in the warm developing bath. Resorcine is likewise dissolved in the warm developing bath. Beta-naphthol is dissolved by boiling together with double the quantity of Turkey oil and twenty parts water; consequently, 100 parts beta-naphthol and 200 parts Turkey Red oil are dissolved in 2,000 to 3,000 parts water and added to the developing bath.

Developer ON is dissolved by boiling together with double the quantity of acetate of soda and twenty parts water; consequently, 100 parts Developer ON and 200 parts acetate of soda are dissolved in 2,000 to 3,000 parts water and added to the developing bath.

By lightly soaping subsequent to developing and rinsing, the shades gain in brightness.

The dyestuffs do not stain cotton, and may for this reason advantageously be employed for the production of two-colored effects, in mixed fabrics composed of acetate silk and cotton, by first dyeing the acetate silk as directed and subsequently covering the cotton with such dyestuffs as do not stain acetate silk.

The American Institute of Chemists announce that a new Chapter has been constituted, which will be known as the "Washington, D. C., Chapter." The officers are: J. F. Couch, president; H. E. Patten, vice-president; J. N. Taylor, secretary; H. L. Lourie, treasurer. Dr. Charles E. Monroe, as an honorary "Fellow" of the American Institute of Chemists, becomes a member of this Chapter.

1925 SPRING COLOR CARD

The Textile Color Card Association of the United States, Inc., has just released the 1925 Spring Season Color Card of America for general distribution to the trade. The release is late this year owing to the fact that the membership of the association has so greatly increased and the demand for cards from members has been so unusually large that the association has been unable to release them owing to its rule of members having priority over distribution. More than three-quarters of the issue has been consumed, and from present indications the demand will be greater than the supply.

The card contains in all eighty-six colors, fourteen in wool, seventy-two in silk, of which six are shoe and leather colors.

Among the color ranges shown in families are sand or natural Kasha shades, called Lido and Biarritz. Also another sand-toned group called Long Beach, Seaside and Sand Dune. The pervenche or Bluet and cornflower shades, also pink-tinted orchids and purple-pinks, called Thistle Bloom and Phlox, are among the outstanding novelties. Greens are represented by the almond-green type and blue-water greens, prominent among which is a shade called Marmora; reds and deep corals—Conch Shell and Fiesta—and purples of reddish tones add brilliancy to the collection. Three new grays are featured—French Gray, Turtledove and Smoked Pearl. The so-called "blonde" shades are characterized by Pablo and Terrapin, recalled from the spring 1924 card. Gobelin blues appear again, as well as new golden yellow and browns, Indian Orange, Nasturtium and Chrysanthemum colors.

In the woolen group, sand or stone shades and rosy tans are stressed. Prominent in this category are shades called Travertine, Limestone, Polo Tan, Rosewood and Sonora. There are also two light grays, Prince Gray and Sea Hawk, and two greens with gray undertones, Pinegrove and Kashmir, and a bright blue called International; a golden yellow—Doubloon—and a rose-tinted orange covers the sport colorings.

The six colors officially selected and adopted by the National Boot and Shoe Manufacturers' Association and the National Shoe Retailers' Association, in cooperation with the Textile Color Card Association, are shown in a special group. These are Priscilla Gray and English Gray; Sudan, a new sand shade, and Madrid, a light Spanish brown; also Vassar and Rugby Tan, two new golden browns especially adaptable for the much wanted Russian calf.

Atlantic Dyestuff Company will not declare its first dividend for several months, as claims amounting to $50,000 were filed with priority claims at bankruptcy proceedings. Objections were entered to giving these claims priority, and if the objections are sustained the dividend checks will be mailed as soon as possible.

Foreign Dyes Imported Through the Port of New York During December

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS OF MANUFACTURERS' NAMES

1—THE SIX LEADING GERMAN COMPANIES

A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873.
B—Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By—Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862.
C—Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K—Kalle & Co., A. G., Biebrich-on-the-Rhine. Founded 1870.
M—Farbwerke, vormals Meister Lucius & Bruning, Hochst-on-the Main. Founded 1862.

2—THE SMALLER GERMAN COMPANIES

BK—Leipziger Anilinfabrik Boyer & Kegel, Furstenberg, near Leipzig. Founded 1882.
CG—Chemikaliewerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1882.
CJ—Carl Jager G. m. b. H., Anilinfarbenfabrik, Dusseldorf. Founded 1823
GrE—Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L—Farbwerk Mulheim, vormals A. Leonhardt & Co., Mulheim-on-the-Main. Founded 1879
tM—Chemische Fabriken, vormals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—SWISS COMPANIES (ALL AT BASEL)

DH—Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G—Anilinfarben-und Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I—Gesellschaft fur chemische Industrie. Founded 1885.
S—Chemische Fabrik, vormals Sandoz & Co. Founded 1887.

4—DUTCH AND FRENCH COMPANIES

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888
NF—Niederlandische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
CN—Compagnie Nationale de Matieres Colorantes et Produits Chimiques. Founded 1917. (Etablissements Kuhlmann merged with this company in 1923.)
P—Societe Anonyme des Matieres Colorantes et Produits Chimiques St. Denis (formerly A. Poirrier). Founded 1830.

5—ENGLISH COMPANIES

Bro—Brotherton & Co., Ltd., City Chambers, Leeds.
BAC—British Alizarine Co., Ltd., Manchester
BD—British Dyestuffs Corporation, Ltd., London.
Cl Co.—The Clayton Aniline Co., Ltd., Clayton, Manchester.
CV—The Colne Vale Dye & Chemical Co., Ltd., Milnsbridge, Huddersfield.
Hol—L. B. Holliday & Co., Ltd., Huddersfield.
Scot—Scottish Dyes, Ltd., Grangemouth.

Owing to the length of these dye import tables if published in full only the common name of each dye is listed, with its Schultz number and total poundage imported and its designation as competitive or non-competitive. Readers may obtain more specific information as to the names of the different types imported under each color, together with the manufacturer of each type, by writing to the Chemical Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C.

THE imports of coal-tar dyes for December, 1924, through the port of New York totaled 314,673 pounds, with an invoice value of $283,655. Imports of dyes through other ports include: Boston, 2,866 pounds, valued at $1,401.

Dyes Remaining in Bonded Customs Warehouse

Date	Coal-Tar Dyes and Colors (pounds)	Coal-Tar Intermediates (pounds)
August 31, 1924	507,338	1,081,287
September 30, 1924	559,661	1,111,656
October 31, 1924	552,556	1,050,037
November, 1924	533,760	1,031,460

Imports of Dyes Through Port of New York, 1924

	Pounds	Value
January	228,743	$232,571
February	158,874	176,657
March	293,862	302,016
April	174,880	182,253
May	167,245	165,521
June	147,380	151,331
July	140,810	137,075
August	64,546	71,290
September	152,743	152,477
October	440,466	455,787
November	359,260	351,887
December	314,673	283,655
Total	2,643,482	$2,662,520

Five Leading Dyes by Quantity Imported

	Pounds
Alizarine Blue Black	25,452
Ciba Violet B	16,530
Indanthrene Pink B	11,724
Indanthrene Blue GCD	11,708
Indanthrene Yellow	11,684

Per Cent by Country of Shipment

Germany	55	Canada	4
Switzerland	27	France	3
Italy	5	England	2
Belgium	4		

Imports of Color Lakes

	Pounds	Value
January	None	None

February	4,181	$1,848
March	11,520	3,343
April	2,956	2,143
May	3,421	1,034
June	330	463
July	390	320
August	250	...
September	1,850	1,281
October	4,593	2,973
November	944	618
December	3,967	2,746
Total	34,402	$16,769

The dyes in this report are grouped by Schultz numbers and in the case of those which could not be identified by Schultz number the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single-strength basis.

The designation of "†" for competitive and "*" for non-competitive indicates the appraisement basis for the assessment of the ad valorem duty in paragraph 28 of the Tariff Act of 1922. Those dyes without designation are doubtful, pending further investigation.

The ad valorem rate for competitive dyes is based on the American selling price, as defined in subdivision (f) of Section 402 of Title IV; the ad valorem rate for non-competitive dyes is based on the United States value, as defined in subdivision (d) of Section 402 of Title IV of the Tariff Act of 1922.

DYES OF COAL-TAR ORIGIN

Schultz No.	Name of Dye	Quantity (pounds)
10	Stilbene Yellow	100
19	Fast Light Yellow	1,102
22	Xylene Light Yellow	17
28	Hansa Yellow G	500
63	Azo Acid Blue	500
88	*Acid Anthracene Brown	401
118	†Geranine	250
121	Erica B	330
175	*Acid Ponceau	220
177	Mordant Yellow	500
180	*Eriochrome Blue Black	1,653
182	†Brilliant Sulphon Red	6,221
273	Diaminogene Blue	1,000
274	†Diaminogene B	300
304	Chrysophenine	1,200
315	Congo Orange	50
332	†Benzo Fast Red	200
339	Brilliant Orange	1,500
343	†Diamine Fast Red	388
358	Diphenyl Red	4,037
368	Brilliant Purpurine 4B	200
370	*Brilliant Congo	50
385	Oxamine Blue 4R	100
392	Toluylene Orange	661
400	Acid Anthracene Red	200
449	Trisulphon Brown	936
456	Benzo Fast Blue	969
474	Oxamine Green B	100
496	*Setoglaucine	1,102
503	†Neptune Green	1,502
505	Light Green (Yellowish)	300
506	Erioglaucine	11,023
515	Methyl Violet	201
516	Crystal Violet	246
524	Acid Magenta	500
543	Patent Blue	1,628
545	†Patent Blue A	1,200
548	Acid Violet 6BN	100
553	*Eriochrome Cyanine	551
556	Coralline Red	560
557	*Chrome Violet	110
559	Victoria Blue B	894
562	Fact Acid Blue	400
564	†Naphthalene Green	1,102
565	Acid Blue B	300
571	Rhodamine 6G (single strength)	2,020
573	†Rhodamine B (single strength)	7,915
576	Rhodamine 3G	200
579	Xylene Red	25
580	Fast Acid Violet B	300
603	Acridine Orange	220
609	Homophosphine OO	2,235
613	Quinoline Yellow N Ex. Conc	1
617	†Columbia Yellow	331
618	Thioflavine T	330
627	*Anthracyanine	220
635	Modern Violet	220
645	*Gallazine	441
658	*Fast Black	441
661	Thionine Blue	200
663	New Methylene Blue	545
672	*Azo Carmine	1,060
673	Azo Carmine B	600
681	*New Fast Gray	661
705	Indamine 6R	1,500
748	Hydron Blue (single strength)	18
759	Anthraflavone G (single strength)	6,270
760	Indanthrene Golden Yellow (single strength)	220
761	Indanthrene Golden Yellow R (single strength)	220
765	Indanthrene Green B (single strength)	618
767	†Indanthrene Violet RR (single strength)	3,569
768	Indanthrene Violet B	700
778	†Alizarine Synthetic Paste	4,494
779	Alizarine Orange	1,197
784	†Alizarine SX Paste	2,180
788	Alizarine Cyanine	798
790	Anthracene Blue SWR Powder	100
794	Cibanone Black	2,205
804	*Alizarine Blue S Powder	400
814	Algol Yellow WF (single strength)	8
816	*Algol Red 5G (single strength)	16
817	Algol Yellow R (single strength)	5,266
819	*Algol Red FF, R (single strength)	1,207
820	*Algol Brilliant Violet R (single strength)	2,750
821	*Algol Brilliant Violet 2B (single strength)	1,399
822	*Algol Brilliant Orange FR (single strength)	3,148
825	Algol Red B (single strength)	16
828	Indanthrene Claret B Paste	165
830	Indanthrene Red R	456
831	*Indanthrene Red BN (single strength)	7,008
832	Indanthrene Violet BN (single strength)	3,688

(*Continued on page* 69)

Technical Notes from Foreign Sources

Elasticity and Tensile Strength of Starch

Starch is such an important commodity from the standpoint of the textile man that any information he can obtain on the properties of this material is of interest. In a recent issue of the Journal of the Textile Institute there appeared an account of the elasticity and the tensile strength of starches as determined from a number of experiments made on the subject.

Pure starch pastes and mixtures which contained the common sizing ingredients were evaporated to form thin films, and the tensile properties of these films were tested at two different humidities. It was found that the starch film behaves very much like a ductile metal, and that there is scarcely any difference between the elastic properties of maize, farina and sago starches.

The maize starch film, however, appeared to be a little "harder" and to show at lower humidities a considerable increase in Young's modulus and in tensile strength. There was a tendency toward increasing "softness" with increasing thickness of the film, and in dry air the films were harder and more brittle than in moist air. Weaker films were obtained of starch that had been treated with hypochlorite, acids, alkalies, or malt extract, and small quantities of soap in the mixing had a considerable weakening action.

If, after treatment with malt, the starch was washed with cold water, the action of the malt on the starch, as regards the tensile strength of the film, was not so pronounced. This indicates that the products of hydrolysis, which are partly removed on washing, are possessed of very little mechanical strength. If softening agents, such as glycerol, castor oil, tallow and Japan wax are added, the film produced is softer and is more or less white or translucent instead of being transparent. If more than 5 per cent of the softening agent is added there is a weakening of the film, and increasing capacity goes hand in hand with decreases in strength. Films containing Japan wax were very weak. The results given apply only to the strength of the dried films, and such questions as penetration, adhesion and lubrication require consideration in connection with the problem of producing a sized yarn with the best weaving properties.

Dyeing Fabrics

Textile materials, such as cotton and wool, are dyed by impregnating them with a solution of a metallic salt containing a protective colloid and subsequently treating them with a coagulating agent which is capable of converting the metallic salt into a pigment. In some instances the textile material may be treated with the coagulating agent first, but it is essential that the pigment shall be produced within the fiber in a colloidal state.

For example, cotton cloth is impregnated with a 1 to 3 per cent solution of ferric chloride which contains from 1 to 3 per cent of glycerine of sugar as protective colloid. This impregnation is carried out at a temperature of 30 to 50 deg. Cent. The cloth is then exposed to the action of ammonia vapors, whereupon a greenish precipitate is formed within the fibers. The full red shade is then developed by treating the cotton with hydrogen peroxide or other suitable oxidizing agent in aqueous solution.

Other shades are similarly produced by replacing the ammonia by hydrogen sulphide, carbon dioxide, potassium ferricyanide, chromates, etc. A very fast dark olive-brown to black coloration is produced on wool by treating it successively with a ½ to 1 per cent solution of colloidal copper containing a protective colloid and 2 per cent solution of sodium ferrate.

This process is patented in British Patent No. 211,912.

Colloid Chemistry of Night Blue

Pure night blue dissolves with difficulty in solvents which have a dielectric constant smaller than 5 to give green solutions in which the dye is molecularly dispersed. In the solvents which have been used for the solution of the dye and which possess a higher dielectric constant, night blue dissolves more readily to give blue colored solutions, which contain colloidal aggregates. These are largest in an aqueous solution.

On the other hand, toluene, which belongs to the first class of solvents, will completely extract the dye from dilute aqueous solutions. Blue shades are produced on filter paper, cotton, and barium sulphate both by the green molecular disperse solutions and the blue colloidal solutions, except in the case of blue aniline solution, which gives greenish blue or green shades on the absorbents named. In the presence of night blue the interfacial tension between toluene and water is doubled, while that of each liquid against air is only slightly raised by the addition of the dyestuff. Night blue precipitated from aqueous solutions by caustic soda dissolves in toluene in the same way as the pure dyestuff and does not appear to be a sodium salt. Kolloid Zeit., 1924, 162.

Making Soluble Starch

The manufacture of a soluble starch which is really soluble in cold water and still possesses all the good properties of starch is a matter of importance to the textile industry. It is reported from Germany that such a starch has been prepared by the action on ordinary starch of the new bleaching agent, which is known as activin or para toluolsulphochloride sodium amide. This agent relates oxygen which effects the solubilization of the starch.

The process is carried out somewhat as follows: The starch is stirred up with the requsite amount of water, which is about ten parts, and then one per cent of activin is added. The mixture is then digested either with direct or indirect steam while it is constantly stirred. The

starch is first converted into a paste, and then as the heating is prolonged it is changed into a thin, sticky liquid which possesses rather remarkable properties as a size or dressing for textile fabrics.

When a good supply of steam is available the process is completed within a period of ten minutes. The starch solution is water-white, but nevertheless it gives all the reactions of starch, particularly the characteristic blue coloration with iodine. This color reaction is absolutely blue and is not tinged with red as is the case with other broken down starch preparations which contain dextrin.

An important advantage of this type of solubilized starch is that the product contains nothing in addition to the decomposition products of starch that will injure the fabrics on which it is employed. For in breaking down, as it performs the oxidation of the starch molecules, activin will give sodium chloride and paratoluolsulphon amide, which are absolutely harmless. The chlorine that is contained in the original substance disappears entirely from the solution in the free state. A simple test of the solution with potassium iodide will instantly reveal this fact.

The solubilized starch obtained in this manner is neither alkaline nor acid, and as it does not contain any disturbing elements in the form of inorganic salt, it may be readily and safely mixed with soaps, oils and fats.

Increasing Affinity of Cellulose Esters to Dyestuffs

The object of the process which is patented in French Patent No. 558,900 is to increase the affinity for cellulose acetate silks, in particular, and cellulose esters in general, for dyestuffs. The process consists in treating the acetate silk with saponifying agents with the addition of soluble aldehydes of oxyaldehydes and then dyeing the fabric. Or the fabric is dyed with dye liquor to which there has been added saponifying agents and soluble aldehydes.

For example, 2.5 grams of cellulose acetate silk is treated for a period of 10 minutes at a temperature of 60 deg. Cent. with 100 c.c. of a solution of barium hydroxide of 5 deg. Be. concentration, to which there is also added 50 c.c. of a 30 per cent solution of formaldehyde. Thereafter, the fabric is dyed in a hydrosulphite vat with Anthraflavone GC. In the place of the solution the barium hydroxide it is also possible to employ a solution of sodium hydroxide, and in the place of the formaldehyde it is possible to use a solution of formaldehyde bisulphite with equally good results. Furthermore, acetaldehyde and acetaldehyde bisulphite may also be used to advantage, as well as formaldehyde sulphoxylate, glyoxal sulphate and glyoxylic acid. It is claimed that the finish and the luster of the dyed artificial acetate silk is not impaired in any way by these chemicals.

Bleaching Cotton Materials

In German Patent No. 385,941 there is described a process for the bleaching of cotton yarn and cotton fabrics in which the cotton materials are first treated with sodium hydroxide solution to which there has been added a small amount of sodium hydrosulphite. The treatment is carried out in a vacuum at a temperature under 100 deg. Cent., for example, at a temperature of from 50 to 70 deg. Cent. The process at this temperature lasts about 3 to 4 hours.

After this treatment the cotton materials are washed, soured and then bleached in the usual fashion. The addition of the sodium hydrosulphite to the solution of sodium hydroxide possesses the advantage of rendering it possible to employ for this purpose a solution of sodium hydroxide of lower concentration, and furthermore the process can be carried out at a lower temperature and does not take as long as the ordinary process in which no hydrosulphite is added to the alkaline bath. In addition to these advantages it is also stated that the consumption of bleaching powder or chlorine is considerably less than formerly.

Chemical Properties of Textile Fibers

In a recent meeting of the Society of Chemical Industry in Nottingham, England, the chemical properties of textile fibers was the main subject of discussion. It was first brought out what was considered as the unit from the textile standpoint, namely, a single hair or fiber, which to all intents and purposes, has but two dimensions, being entirely flexible in the third. The point was then made that with this material it is necessary to cover three-dimensional persons, furniture and the like. A scale model of a cotton fiber made of rubber tubing ½ inch in diameter, would be 60 feet long. It is evident that all the surface properties of such fibers would be of considerable importance.

The problem of general discussion was then approached from the angle of the luster of the fabric produced by mercerization. This also included the determination of the transparency of the fabric. Photographs of fabrics which were stretched and unstretched during mercerization showed much smoother surface in the former, and the disappearance of the folds and creases would account for the superior brilliancy and increase in the intensity of the light regularly reflected. In order to measure the intensity of light reflected at various angles, a special form of Joly's photometer has been designed. Most of the increased luster shown in a mercerized fiber is due to the light that is regularly reflected in a direction along the length of the fiber. This regular reflection is intermediate in intensity between that from glass and that from unmercerized fabrics, in which the luster due to the single fibers was enhanced. A mercerized fabric also shows a distribution of very bright and very dark spots.

At River Point, R. I., the H. & H. Manufacturing Company, Inc., has been incorporated with authorized capital of $50,000, to make rayon silks and linings. Wm. Horwitz, of New York, is president, and H. Hassenfield, treasurer. The company, which is beginning operations in the plant formerly owned by the Pawtuxet Valley Textile Company, has an equipment of 100 looms.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

CHRYSOPHENINE G
(Schultz No. 304)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: With common salt at the boil. Addition of phosphate of soda makes the shade a little lighter.

SHADE: Bright medium shade of yellow.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO (On Cotton):
Acid: Will not stand acid.
Alkali: Fast.
Cross-Dyeing: Will not stand cross-dyeing.
Ironing: Good.
Light: Good; better than Stilbene Yellow.
Potting: Bleeds off.
Rubbing: Fast.
Steaming: Fast.
Sulphur: Fast.
Washing: Bleeds badly.
Water: Does not stand Markischer test.

FASTNESS TO (On Wool):
Acid: Not fast against acids.
Alkali: Fast to alkali.
Carbonizing: Will not stand carbonizing.
Fulling: Fair; stains white silk slightly, cotton badly.
Potting: Bleeds off.
Rubbing: Fast.
Scouring: Bleeds off badly.
Steaming: Fast.
Sulphur: Fast.
Washing: Stains white cotton, but not wool.

SENSITIVE TO METALS, LIME: Dyed in a copper vessel, slightly redder and duller.

DYED BY OTHER METHODS: Suitable for coloring cloth in the starch mangle. Diazotized and developed, produces no change in the properties.

ON UNIONS: Cotton-wool unions: The wool is dyed much fuller than cotton.

ON OTHER MATERIALS: Paper: Used on unsized rag and cellulose. Not as good on wood pulp. Fast to light. Wool: Dyed with Glauber salt and acetic acid. Top-chromed, no faster. Will also dye chromate. Cotton-silk unions: The silk is rather light dyed with soap, soda and Glauber salt. The silk is white dyed with soap at 100 deg. Fahr.

PRINTING: Suitable.

DISCHARGING: Discharges white with tin zinc or sulphoxalates.

REMARKS: Dyed on cotton-wool-silk union goods, ½ per cent dyeings: With 10 per cent common salt, one hour at 100 deg. Fahr.—silk and cotton equal; wool is lighter. With 10 per cent soap, 10 per cent Glauber salt, one hour at 100 deg. Fahr.—silk one-fourth as heavy as the cotton; wool nearly white. With 10 per cent soap, 5 per cent soda ash, one hour at 80 deg. Fahr.—silk one-fourth as heavy as the cotton; wool is white. With 10 per cent soap, 10 per cent phosphate of soda, one hour at 80 deg. Fahr.—silk a little lighter than the cotton; wool white.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; E. I. du Pont de Nemours & Co.; Essex Aniline Works (Selling Agents, Grasselli Dyestuff Corporation); National Aniline & Chemical Company; Newport Chemical Works, Inc.; Calco Chemical Company.

CONGO RED
(Schultz No. 307)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton and wool.

USUAL METHOD OF DYEING: On cotton, with common salt and soda; on wool, with acetate of ammonia.

SHADE: Similar to Alizarine Red, dull.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Poor.

LEVEL: Does not dye level on wool.

EXHAUSTS: Fairly well.

FASTNESS TO (On Cotton):
Acid: Turns bluer.
Alkali: Fast.
Boiling: Will not stand boiling.
Chlorine: Will not stand chlorine.
Cross-Dyeing: Will not stand cross-dyeing.
Fulling: Color bleeds.
Ironing: Fast.
Light: Not fast to light.
Scouring: Scours off.
Washing: Bleeds off.
Water: Does not stand Markischer test.

FASTNESS TO (On Wool):
Acid: Turns bluer.

Alkali: Fast.
Carbonizing: Will not stand carbonizing.
Fulling: Color bleeds into whites.
Ironing: Fast.
Light: Not fast to light.
Rubbing: Crocks slightly.
Scouring: Scours off.
Steaming: Fast.
Washing: Will stand neutral soap.

SENSITIVE TO METALS, LIME: Sensitive to iron and copper; the shade is duller.

MACHINE DYEING: No interest.

ON UNIONS: Cotton-wool unions: Both fibers the same depth. Cotton-silk unions: Both fibers the same depth.

ON OTHER MATERIALS: Silk: Dyed in a weak acid bath and after-treated with tannic acid, the color is fairly fast to washing. Paper: Works well on sized and unsized pulp with a small amount of soda.

DISCHARGING: Discharges white with hydrosulphite.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; E. I. du Pont de Nemours & Co.; Grasselli Dyestuff Corporation; National Aniline & Chemical Company; Newport Chemical Works; Noil Color & Chemical Works; Calco Chemical Company.

CONGO CORINTH G
(Schultz No. 312)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: With common salt and soda ash.

SHADE: Dull Bordeaux.

SHADE BY GASLIGHT Redder.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Will not stand acid shade; turns black.
Alkali: Will not stand alkali; turns a bright red.
Chlorine: Will not stand chlorine.
Fulling: Very moderate; bleeds badly.
Ironing: Fast.
Light: Stands seven days' exposure.
Perspiration: Not fast.
Rubbing: Fast.
Scouring: Moderate; scours off badly.
Steaming: Bleeds.
Washing: Moderate; scours off badly.
Water: Bleeds badly in water at 120 deg. Fahr.

DYED BY OTHER METHODS: May be diazotized and developed, and also after-chromed and chromed, but none of these methods produces a shade of any interest. Generally speaking, the color is of no great value.

ON UNIONS: Cotton bluer than wool on cotton-wool unions.

ON OTHER MATERIALS: No interest.

DISCHARGING: Gives a fair white with zinc dust; with tin crystals, discharge is yellow.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.); American Aniline Products, Inc.; Central Dyestuff & Chemical Company; Croton Color & Chemical Company; Grasselli Dyestuff Corporation; National Aniline & Chemical Company; Newport Chemical Works; Noil Color & Chemical Works.

ORANGE TA
(Schultz No. 311)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Direct from a common salt bath.

SHADE: Reddish shade of orange.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Slowly.

FASTNESS TO:
Acid: Will not stand acids.
Alkali: Will not stand alkali.
Chlorine: Color destroyed.
Ironing: Fast.
Light: Fugitive.
Rubbing: Fast.
Washing: Average for benzidine colors.
Water: Average for benzidine colors.

ON UNIONS: Chiefly used for union dyeing.

DISCHARGING: Does not discharge white.

COMPETING PRODUCTS: Made in the United States by National Aniline & Chemical Company.

DYES IMPORTED DURING DECEMBER

(Concluded from page 65)

Schultz No.	Name of Dye	Quantity (pounds)
833	Algol Olive R (single strength)	5,990
834	Algol Gray	67
838	Indanthrene Blue RS (single strength)	900
840	Indanthrene Blue 3G	929
842	Indanthrene Blue GCD (single strength)	11,708
843	Cibanone Blue G Powder	55
844	*Algol Blue 3G (single strength)	2,011
849	Indanthrene Yellow (single strength)	11,684
852	*Alizarine Irisol D, R	1,157
853	*Anthraquinone Violet Powder	331
855	Alizarine Pure Blue B	4,255
856	*Alizarine Astrol	550
858	†Alizarine Saphirol B	4,166

Schultz No.	Name of Dye	Quantity (pounds)
862	†Alizarine Blue Black B	25,452
863	Anthraquinone Green	200
865	*Alizarine Cyanine Green 3G Powder	100
868	Cibanone Brown (single strength)	1,001
869	*Algol Brown B (single strength)	8,811
871	Indanthrene Red Violet RRN	368
873	Helindone Brown AN	200
874	*Indigo, Synthetic	1,076
876	Indigo, White	55
881	Brilliant Indigo 4B (single strength)	4,042
892	Helindone Green G (single strength)	350
893	*Alizarine Indigo G Paste	1,193
894	Alizarine Indig B (single strength)	2
901	Ciba Violet B (single strength)	16,530
904	Helindone Brown (single strength)	550
907	Ciba Scarlet (single strength)	1,720
908	Ciba Red R Paste	2,204
910	Helindone Pink	220
912	*Thioindigo Red B (single strength)	995
913	Helindone Orange R	2,051
915	*Helindone Fast Scarlet R (single strength)	2,500
918	*Helindone Red 3B (single strength)	1,830
920	Helindone Violet (single strength)	250
923	Ursol	25

UNIDENTIFIED DYES

ACID DYES

Name of Dye and Manufacturer	Quantity (pounds)
Acid Rhodamine 3R—(I)	220
Alizarine Geranole B Powder—(By)	882
*Alizarine Rubinol 3G Powder—(By)	200
Alizarine Uranol 2B Powder—(By)	1
†Alkali Fast Green 3G—(By)	100
Alkali Fast Green 10G—(By)	100
Azo Flavine FFNX—(B)	100
Brilliant Milling Red R—(C)	500
*Fast Light Red BL—(By)	445
*Kiton Fast Red 4BL—(I)	1,100
Mars Red ATX—(B)	100
Radio Black SB—(C)	200
Sulphon Orange G—(By)	200
†Sulphon Yellow R—(By)	441
Supramine Red B—(By)	200
*Supramine Red 2G—(By)	221
Supramine Yellow R—(By)	441
*Wool Black BR—(By)	1,103
Wool Fast Blue BL—(By)	1,257

VAT DYES

Name of Dye and Manufacturer	Quantity (pounds)
Algol Blue CF (single strength)—(By)	8
Algol Brilliant Pink FB Powder—(By)	99
Algol Pink TR (single strength)—(By)	16
Alizarine Indigo 7R Powder—(By)	2
*Alizarine Indigo Black B Paste—(By)	110
*Alizarine Indigo Brown R Paste—(By)	2,293
Alizarine Indigo Red B Powder—(By)	1
Ciba Pink BG—(I)	1,102
Helindone Claret Red B Paste—(M)	200
Helindone Pink B (single strength)	2,300
Helindone Printing Black RD Paste—(M)	7,500
Helindone Red 15 GK Paste—(M)	200
*Hydron Pink GR Paste—(C)	1,325
Hydron Navy Blue C Paste—(C)	150
Hydron Pink (single strength)	732
*Hydron Scarlet (single strength)	1,996
Hydron Violet (single strength)	100
Hydron Yellow NF Paste—(C)	1,500
Indanthrene Black BGA (single strength)	882
Indanthrene Blue BCS (single strength)	1,220
†Indanthrene Blue RZ (single strength)	1,624
Indanthrene Brown (single strength)	10,737
Indanthrene Brown 3R	620
*Indanthrene Golden Orange 3G (single strength)	55
*Indanthrene Green G (single strength)	200
Indanthrene Pink B (single strength)	11,724
Indanthrene Pink R	2,110
*Indanthrene Red GG (single strength)	1,971
Thioindigo Rose RN Extra Paste—(K)	220
Vat Blue GCN Powder—(By)	1
Vat Printing Black BR—(By)	11
Vat Yellow GP Powder—(B)	50

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